A CHILTON PUBLICATION

JAN 7 1954

# The Iron Age

th ANNUAL REVIEW AND FORECAST ISSUE — January 7, 1954

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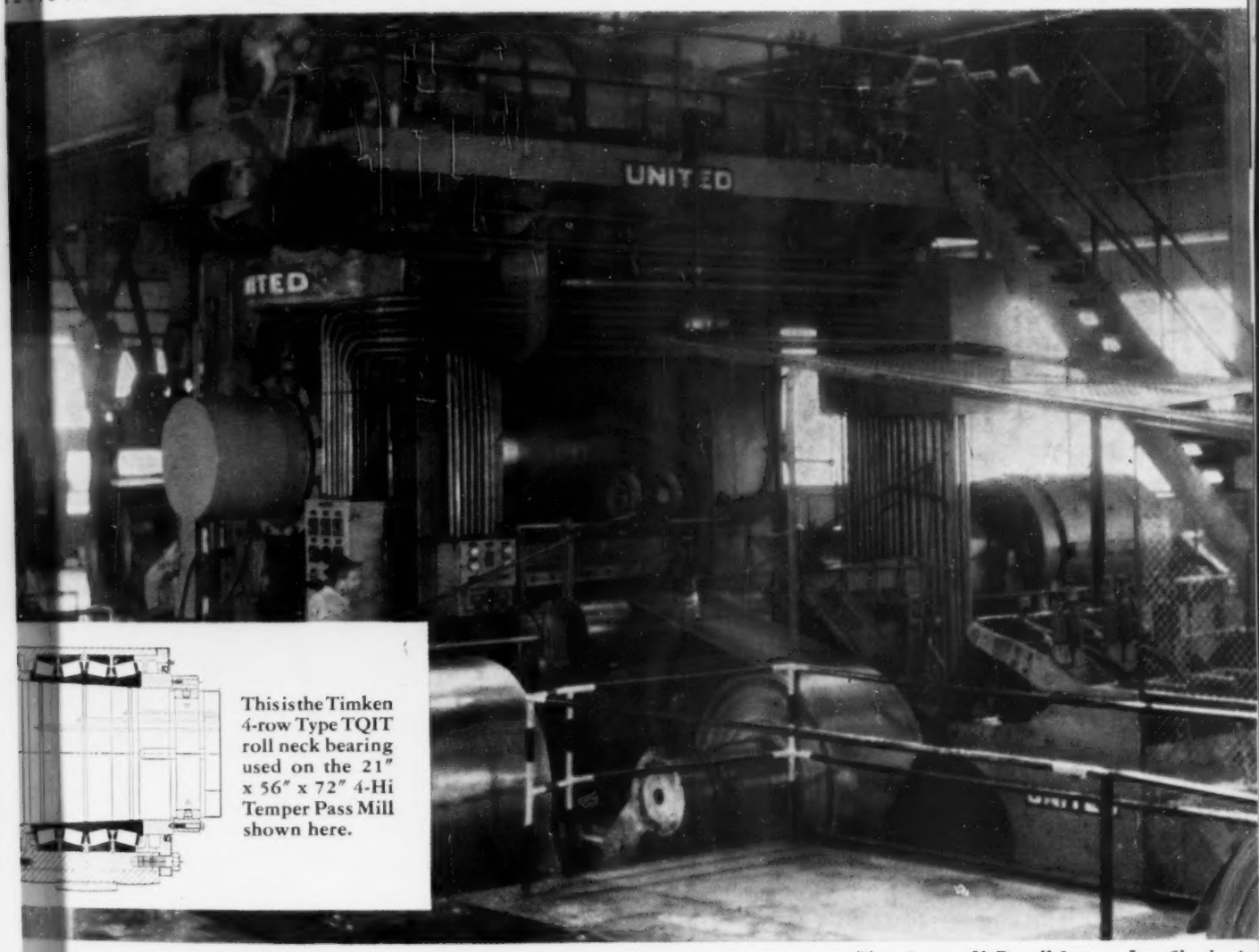





This is the Timken 4-row Type TQIT roll neck bearing used on the 21″ x 56″ x 72″ 4-Hi Temper Pass Mill shown here.

*Photo Courtesy McDowell Company Inc., Cleveland*

# Cuts wheel cost $1500 per year


**The job:** Cleaning department of foundry was using 8″ wheels with 4500 rpm grinders. When worn down to 5″ or 6″, wheels lost surface speed and metal removal dropped off. Wheels were laid aside or thrown away at this point.

**Solution:** Rotor Analyst suggested use of two Rotor 6000 rpm air grinders to use up discarded stub wheels.

**Results:** Investment of $400 in new Rotor Grinders saves $1500 yearly in wheel costs.

How much will this idea save in *your* plant? Ask your Rotor Analyst for a trial grinder to find out!

## ROTOR GRINDER FACTS

**Rotor D125—6000 rpm—9¾ lbs.**
**Rotor D88—6000 rpm—9 lbs.**

Others from 3100 to 20,000 rpm. Straight or spade handles. Ask for Catalog No. 38.

AIR

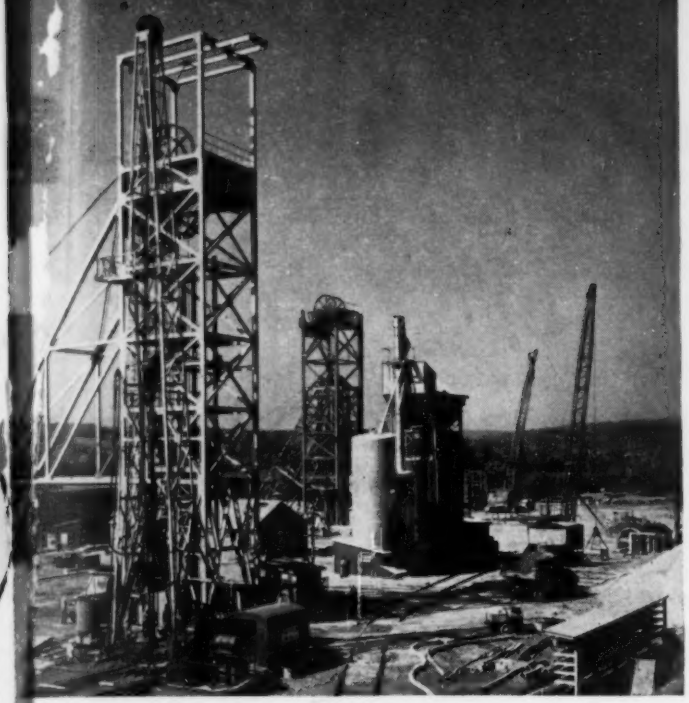
THE ROTOR TOOL CO.

CLEVELAND, OHIO

*UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS*

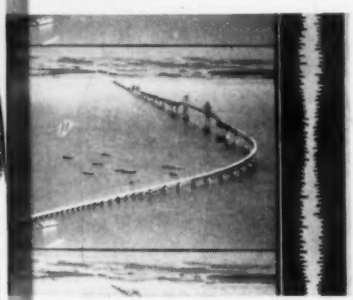
HIGH CYCLE

# From 1953 Highlights at Bethlehem



**DEVELOPMENT PROCEEDS AT GRACE MINE.** The year saw steady progress in the development of Bethlehem's new magnetite ore property in eastern Pennsylvania, the Grace Mine near Morgantown. The main haulage shaft is well on its way to an ultimate depth of 2500 ft, and a second shaft for men and materials has been started. Most of the surface buildings have been largely completed and hoisting engines have been installed. When in full operation a work force of about 1250 will be required.

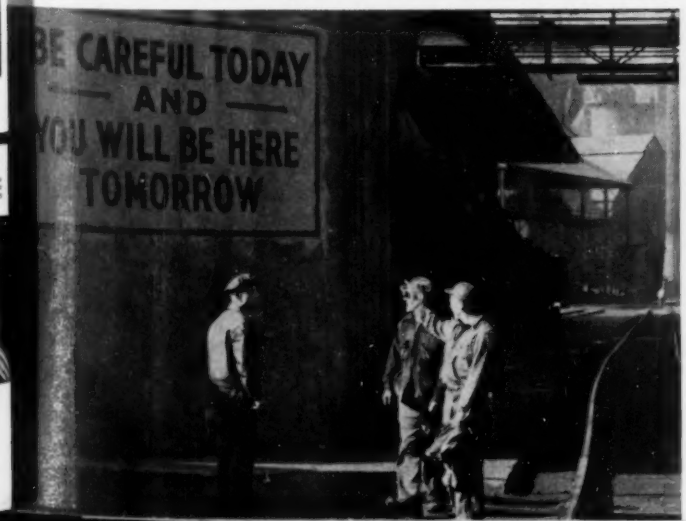
At the same time, development of the new ore mine at Marmora, Ont., Canada, has also gone forward.



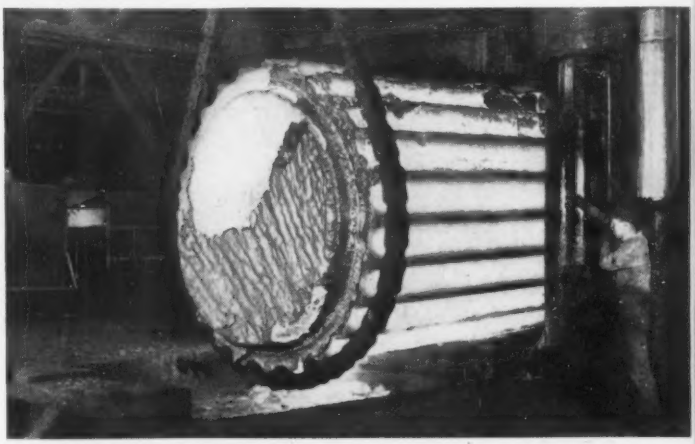
**NEW FILM SHOWS SPANNING OF CHESAPEAKE.** The erection of more than four miles of steel superstructure for the Chesapeake Bay Bridge by Bethlehem's Fabricated Steel Construction Division is shown in a new color movie, "Steel Spans the Chesapeake." This 16-mm sound film is now available to the public for showings before interested groups.

**NEW PROGRESS IN SAFETY.** 1953 brought gratifying recognition of safety accomplishments. During the year 32 Bethlehem operations received awards from the National Safety Council in recognition of outstanding safety performances.

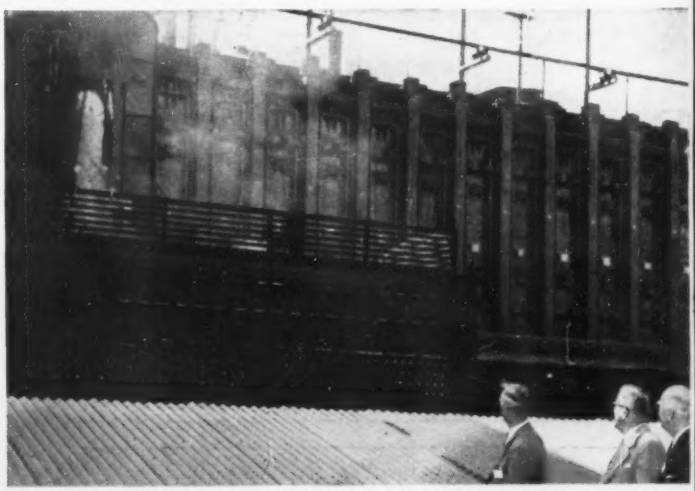
In addition, in the large-steel-plant division of the Metals Section contest, first, second and third places went, respectively, to the Bethlehem, Johnstown and Lackawanna plants. This award makes the eleventh straight year that a Bethlehem plant has won the contest in this division.




**GROWING TREND TOWARD HIGH-STRENGTH BOLTING.** Steel erectors are more and more discovering the saving in time and other advantages of joining structural members with high-strength bolting instead of field-driven rivets. One result: high-strength bolts are moving in steadily-mounting volume from our fasteners plants to meet the growing demand.



**350-TON INGOT.** This giant, one of the largest ingots ever made, with a diameter of 11 ft 2 in. and weighing better than 700,000 lb, yielded the steel for a forging 70 ft long, to form one of the columns of a 25,000-ton press, part of the Air Force heavy-press program.



**NEW COKE OVEN BATTERY.** The picture shows the first "push" of coke as it tumbled from the newly-completed battery of 80 by-product ovens at the Bethlehem Plant. This new battery has added 1300 tons daily to the plant's coke capacity.

BETHLEHEM STEEL

The Iron Age

# 99th Annu

Vol. 173, No. 1, January 7, 1954

*Starred items are digested at the right.

## EDITORIAL



## ANNUAL REVIEW AND FORECAST



## PRICE AND PRODUCTION DATA



## SPECIAL FEATURES



## NEWS OF INDUSTRY



## MARKETS & PRICES



## REGULAR DEPARTMENTS



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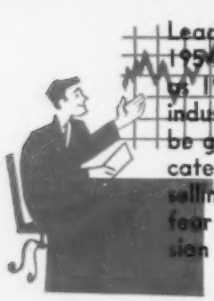
THE IRON AGE, published every Thursday by the CHILTON CO. (INC.), Chestnut & 56th Sts., Philadelphia 39, Pa. Entered as second class matter, Nov. 8, 1932, at the Post Office at Philadelphia under the act of March 3, 1879. $8 yearly in United States, its territories and Canada; other Western Hemisphere Countries, $15, other Foreign Countries, $25 per year. Single copies, 25¢. Annual Review and Metal Industry Facts Issue, $2.00. Cables: "Ironage," N. Y.

**Address mail to 100 E. 42 St., N. Y. 17, N. Y.**

### Industry Leaders Appraise Business....P. 247



Leaders of industry told The Iron Age 1954 will be not quite as good a year as 1953, which saw records set in many industries. But the year ahead will still be good. Highlights of their views indicate stiffer competition and tougher selling ahead. But there is little if any fear of depression, or even deep recession in 1954.

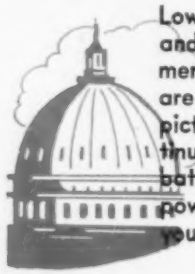
### Freight Grows as Steel Sales Factor...P. 248

With competition sharpening, freight absorption will play an increasingly significant role in the steel market in 1954. Neither customers nor producers are going overboard. Buyers will want to stick to good suppliers in case of a market switch. Producers must check costs. Comprehensive Iron Age survey lists rail shipment costs.

### Auto Industry Faces Acid Test in '54...P. 258

Most critical year of the decade is the way a key automotive figure describes 1954. In the next 12 months the industry will find out if it has planned and built correctly to meet the challenge of prospering, providing jobs and markets in a peaceful and free economy. Available evidence indicates it has. Output predictions are high.

### Build Stronger Business Base in '54...P. 263



Lower taxes, more for taxpayers' dollar and continued withdrawal of government from areas of private enterprise are positive points in 1954 Washington picture. But deficit spending will continue. Economists ponder means of combatting sharp slides and military manpower demands will continue to drain younger workers from industry.

# Dear Editor:

*Letters from readers*

### Salute to a Salute

Sir:

The challenge of writing an editorial weekly must be stimulating and certainly prevents your activities from becoming routine.

It may be a coincidence, yet, as I read your Dec. 10 issue, I was agreeably surprised to find my cherished friend of long standing, Mr. A. N. Kugler being honored with your "Salute." In this particular instance, I can go along with you since I know something of Mr. Kugler's accomplishments.

By way of getting further acquainted, I want to tell you that for the past 4 years we have been operating our foundry with Olivine base sand. In so far as I know, ours is the only operation in America, although the Norwegian foundries have recognized the virtues of Olivine and I have been told are using it in all of their steel operations.

*G. S. SCHALLER*
*Professor of Mechanical Engr.*
*University of Washington*
*Seattle*

### Make Sure Slings Are Safe

Sir:

This company desires to reproduce certain data published in your magazine, and permission to do so is requested.

Our Industrial Engineering Department is preparing a manual on materials handling. This will be distributed within our organization to supervisors and engineers as an aid in solving handling problems. It is not anticipated that the publication will receive wide distribution. Most of the criteria to be included were developed locally, and are based on records carrying military security classifications. The value of the manual, however, could be increased by including all or part of the article which appeared in the July 9 issue entitled "How to Make Sure Your Slings Are Safe." Full recognition of the source will be given.

*T. J. SULLIVAN*
*Manager of Contracts*
*Consolidated Vultee Aircraft Corp.*
*Fort Worth, Texas*

You certainly have our permission to reprint this article.—Ed.

### Spray Lubrication

Sir:

With reference to the article on spray lubrication in the Aug. 6 issue of THE IRON AGE, written by E. C. Beaudet, we would be very interested to know the actual oil used which you state is smokeless and odorless. We have been experimenting in this direction in this works but so far have not obtained an entirely suitable oil.

*R. BALLANTYNE*
*Tool Engineering Group*
*Davy and United Engineering Co., Ltd.*
*Sheffield, England*

The oil referred to in our article "Better Setups, Spray Lubrication Increase Parts Output" is called "Lusol." It is an emulsifiable cutting oil manufactured by the F. E. Anderson Oil Co., Portland, Conn. —Ed.

### Inside Red China

Sir:

May we have your permission to reprint from your Dec. 3 issue the article entitled: "Inside Red China's Steel City"?

Since the story is largely pictorial, it would be necessary for us to borrow the original art work, if you will cooperate by making it available for our use. The usual credit line will be given, and we will furnish you with copies of the issue in which we use the material.

It is our feeling that the American foreman should be aware of the Soviet-Chinese industrial expansion program and the real progress which has already been made.

*GEORGE BRENN*
*Editor*
*The Foreman's Digest*
*Englewood, N. J.*

We'd be glad to give you permission to reprint this article, but we no longer have the photos—Ed.

### Sintered Carbides

Sir:

We will appreciate a tear sheet of the article entitled "Sintered Carbides Open New Industrial Horizons," by John W. Graham, as it appeared in the Aug. 13 issue of THE IRON AGE.

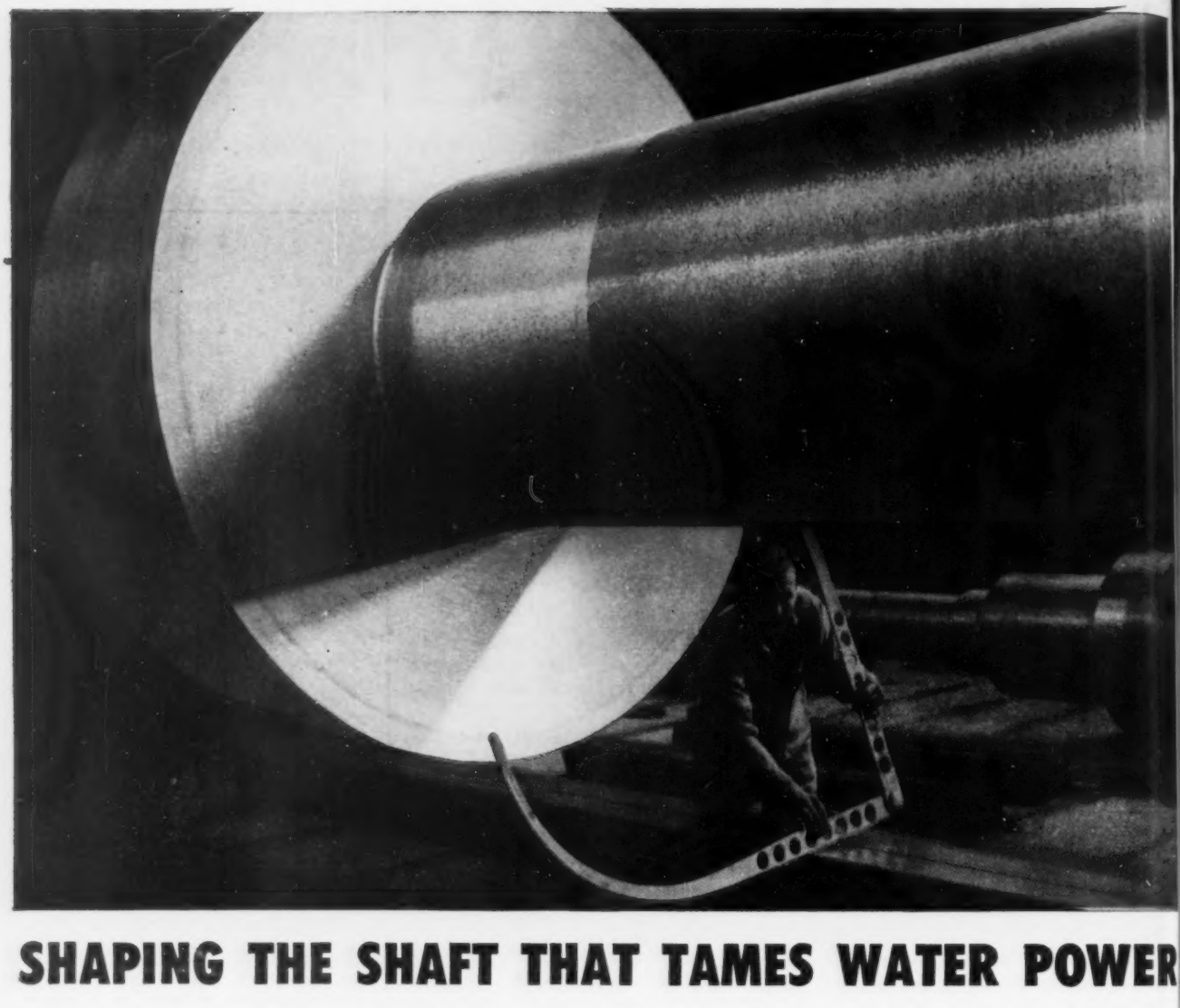
*L. H. SCHAUT*
*Purchasing Agent*
*Keystone Carbon Co.*
*Saint Marys, Pa.*

### Plastic Pipe Chart

Sir:

I would like to receive four tear sheets of p. 90 of the Nov. 19 issue. This is the chart showing "Properties of Common Materials Used in Plastic Pipe."

*J. A. WEAVER*
*Purchasing Agent*
*The Wean Engineering Co., Inc.*
*Warren, Ohio*



# SHAPING THE SHAFT THAT TAMES WATER POWER

Product — shaft for hydro-electric generator
Overall Length — 22'8¾"
Flange Diameter — 80⅛"
Body Diameter — 34½"
Weight — 100,600 lbs.

When a hydro-electric turbine is built it must last for scores of years. That is why leading builders of this equipment come to Midvale regularly for shaft forgings.

This large 22-foot shaft being given the final check is an example of Midvale production. Exact in metallurgical specifications because of the experienced steel making practices and complete open hearth and electric furnace facilities to fit the job. Carefully forged by hands with years of forging skill on presses from 1,500 tons to 14,000 tons capacity. Heat treated in temperature controlled furnaces to assure stability of structure throughout the shaft with the best combination of strength and ductility. Then machined to final dimensions on lathes especially designed for this type of work.

This is the reason Midvale forgings — whether 300 or 300,000 pounds — are noted for their long service and never failing performance. The men of Midvale working with the right equipment and facilities offer a source of forgings, steel mill rolls and rings unsurpassed in quality and extra performance. Let their service, long experience and willingness to solve your problem help you.

*THE MIDVALE COMPANY - Nicetown, Philadelphia 40, Pa.*

*Offices: New York, Chicago, Pittsburgh, Washington, Cleveland, San Francisco*

**MIDVALE**

*FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS*

# Fatigue Cracks

*by William M. Coffey*

### The Annual

This issue is known as The Annual. Throughout the metalworking world it is eagerly welcomed each year as the authoritative encyclopedia of the industry, packed with ever-useful statistics, facts and predictions — solid editorial meat. It is with unparalleled relief, we know, that the editors once again leave it in your hands—and get it off theirs.

No one can quite imagine, except the wives of the editors and the psycho staff at Bellevue, the pain, trouble, toil and labor (Shakespeare, King Leer, A.III, S.68, Line 1086, Witches Brew 3.2) that went into it. The score at last counting showed four acute cases of ulcers[1], six divorces, one suicide and [2]two desertions. The only member of the staff left without annualitis is ourselves because we didn't have anything to do with The Annual. As you can see, we've retained our complete sanity. We feel, however, that it would be fitting to mention in Fatigue Cracks that this is The Annual. This is the Annual.

There are a great many uses for The Annual. It makes a fine base for an automobile jack. It can be used for that extra two inches to bring the baby's mouth into juxtaposition with the oatmeal. We have heard that it makes excellent ballast for small sail boats, especially when wet. *(We will be happy to quote on bulk lots for larger boats.)*

. . . and, if you are so inclined, you may wish to thumb through it. You'll find some old friends like the famous year-end Production Roundup, The Washington Scene, The Automotive Outlook, Business Roundup, the popular Trade Association Directory. And you'll find some new features. One of the most useful is the Freight Rate Chart which shows 10,000 freight rates on steel, covering 55 major steel producing points to 90 major steel consuming points. A wonderful boon for the harried Purchasing Agent. Our Handbook of Terms, published last winter, proved so popular that you will find a continuation of it here covering terms used in aluminum, copper and magnesium.

If you will permit us to be sober for a sentence, we will say that you will find quite a book here. Study it, save it, refer to it. You'll find answers to a thousand and one questions that will keep cropping up in the year ahead.

*[1]Our family relations team has gone into action. High hopes for saving at least one couple. A little scarred, but saved.*

*[2]Mr. Nehru is talking to these fellows.*

### Mark These Dates

. . . on your calendar. We've received from *Printers Ink*, the annual listing of important commemoratory days, weeks and months for 1954. We leave to your own good judgment how you celebrate them. They do make good excuses for taking a day off now and then.

January—**Egg Month.**

Jan. 14-23 — **Idaho Potato and Onion Week.**

Jan. 15-23—**Anniversary of the Week.**

Jan. 15-23—**Anniversary of the Tea Bag.**

Jan. 20-30—**Large Size Week.**

Jan. 23-30 (tentative)—**National Crochet Week.**

Jan. 24-30 — **National Potato Chip Week.**

February will be Butter Frostings Month.

### Puzzlers

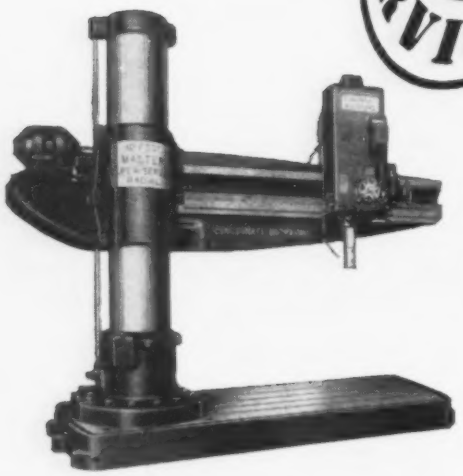
The grandfather is 90 years old, the father is 45 and the son is 15. The winners: George L. Deschambeau, Steve Buck, Phyllis W. Fye, J. O'Keefe, Jim Harvener, Janet M. Wocel, Mario Puig, J. S. Prifogle, Janet Aho, Donald F. Stoneburner, A. J. Reardon, Harris H. Clark, L. B. Froehlich, J. H. McDonald, Gustaf A. Alsterlund, Milo M. Bowman, Norman H. Ferguson, Mrs. Betty Thomas and Mr. Rice. Just a trifle too easy?

### New Puzzler

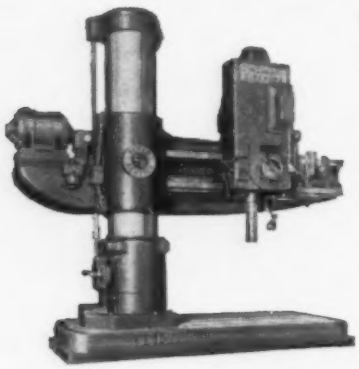
There they stood about to kill each other. One pirate had his two guns trained on the other one, who was carrying their eight-quart pail full of water—all the fresh water there was on the island. They had agreed on a swap—one gun for half the water. But then they had reached a stalemate because they only had a five-quart bucket and a three-quart pitcher to divide the water. Each was stubborn to the death. If the gunman shot, his pal would dump the water in the sand and he would shoot rather than see a drop of water go the wrong way. Suspense! But before the shot rang out, one of them found a way to divide the water into two equal parts. Can you?

# There's a SUPER SERVICE for your job...

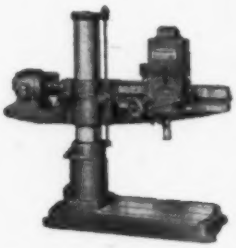
For greatest savings in drilling cost The Cincinnati Bickford Tool Company offers a complete line of 34 different sizes and types of drilling machines. One of these machines will cut your drilling costs. Our engineers will help you select the proper machine for your work. Write for bulletins on the machines that interest you.



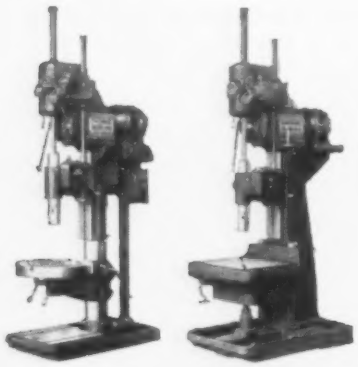
The SUPER SERVICE Master Radial Drill, as described in Circular R-22, is built in 7′ to 12′ arm lengths and in 22″ and 26″ diameter columns. This machine has 36 speeds and 18 feeds powered by motors from 20 to 40 HP.



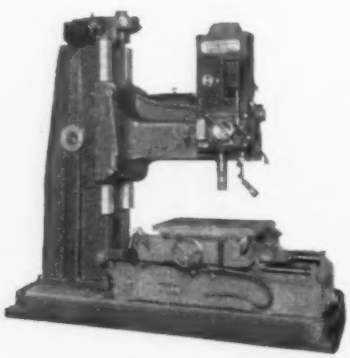
The 36-speed 18-feed SUPER SERVICE Radial Drill, as described in Booklet R-29, is furnished in 13 different standard sizes, ranging from 3′ to 8′ arm lengths and 11″ to 19″ diameter columns. These machines are furnished with 7½ to 20 HP driving motors.



The 9″ Diameter Column SUPER SERVICE Radial Drill, as described in Circular R-21C, is built in either a 3′ or 4′ arm length with 9 speeds and 4 feeds powered with a 3 HP driving motor.



The SUPER SERVICE General Purpose Upright Drilling Machines, as described in Booklet U-25, are furnished in 21″, 24″ and 28″ sizes. From 8 to 12 speeds and 4 to 9 feeds. The machines are powered by either 3, 5 or 7½ HP motors.



The new SUPER SERVICE Precision Drilling Machine is especially suited to operations in conjunction with an automatic spacing table. This 36-speed 18-feed 15 HP motor machine is more completely described in Circular FH.

The SUPER SERVICE High Production Manufacturing Type Uprights have many of the advantages of the general purpose drilling machines but, due to their simplified construction, they are much more economical. They are furnished in 21″, 24″ and 28″ sizes with 3, 5, 7½ or 10 HP driving motors. Booklet U-27 will furnish you more complete details.

**CINCINNATI BICKFORD**

**RADIAL AND UPRIGHT DRILLING MACHINES**

**THE CINCINNATI BICKFORD TOOL CO.**

**Cincinnati 9, Ohio, U.S.A.**

# FORECAST: What Industry Expects in '54

◆ Top industry executives tell The Iron Age what they believe this year's business prospects are. Most expect a slight decline from '53 but say this year may be "second best."

◆ One aluminum industry spokesman believes 1954 will be the best ever. Westinghouse predicts record sales this year. Stiffer competition, increased sales effort to mark '54 business pattern.

### STEEL

**E. J. Hanley,** president, Allegheny Ludlum Steel Corp.: ". . . stainless steel will experience temporary fluctuations in demand, but we are confident that the long range trend will continue sharply upwards."

**M. D. Howell,** executive vice-president, American Iron and Steel Institute: "There is no indication of a substantial setback in the near future for the steel industry . . . demand for steel is still brisk although moderately reduced from the unusually high levels of a few months ago."

**C. R. Tyson,** executive vice-president, John A. Roebling's Sons Corp.: "Judging from our present backlog of orders . . . 1954 will be another good year."

**C. M. White,** Republic Steel Corp.: "Business could retreat from the high level of the past few years and still be good business. I for one cannot see anything in the near future to alarm us . . . With a continuation of the type of business-like government we are now receiving, our economy should continue its steady upward climb."

### FOUNDRY

**H. Trenkamp,** president, Gray Iron Founders Society, and Ohio Foundry Co.: ". . . Gray iron shipments in 1954 should average out to at least 1 million tons per month.

### ALUMINUM

**R. S. Reynolds, Jr.,** president, Reynolds Metals Co.: "...1954 promises to be a selling year, the biggest in the aluminum industry's history...supply will be greater than ever before....Primary aluminum production is expected to approach 1.4 million tons, about 12 pct more than in 1953."

**I. W. Wilson,** president, Aluminum Co. of America: "Alcoa is optimistic about the future....It is expected that the government will continue to stockpile metal during 1954....The annual rate of stockpiling is expected to increase during the coming year."

### AUTOMOTIVE

**L. L. Colbert,** president, Chrysler Corp.: "In the year ahead people of the U. S. will profit from continued competition for automotive sales. They will be given greater choice of automotive prod-

*Continued on Page 255*

REVIEW | FORECAST

## Don't Miss These Latest Developments—And Tips on Things to Come

# FREIGHT: Growing Steel Sales Factor

**Absorption to become increasingly important as steel sales get more competitive in '54 . . . But no one wants to move too fast . . . Iron Age study lists rates—By J. B. Delaney.**

Freight absorption will play an increasingly significant role in the steel competitive picture during 1954. Both producers and consumers are accepting the situation for what it is—an inevitable result of more competitive conditions in the industry.

Neither customer nor producer appears to be going overboard. The customer is tempering his enthusiasm toward lower delivered prices with the desire to stick with a good supplier just in case the pendulum swings the other way. It has done this before and many a consumer has kicked himself for taking temporary advantage of the situation. Producers are meeting competition where they find it, but they apparently have no intention of trying to remain in market areas that are too far distant from their producing plants. An exception to this is in tinplate, where Pittsburgh area producers find it necessary to absorb some freight to the West Coast.

Another tempering influence is the sizable increase in freight rates during the last 7 years. Higher rates today are something to be reckoned with in relation to profit margins on steel products, unlike the days when they were low enough that a producer could ship into any market without suffering unduly. As a matter of fact, some mills have already withdrawn from areas they were shipping to when the customer paid the freight. A possible exception to this would be stainless steel, where the selling price makes possible freight absorption in greater amounts.

Absorption of freight by producers began in earnest last October, probably before that in some products, as demand and supply came into balance and the mills became aware that the customer was in position to call the turn.

At year's end, products on which freight was being absorbed included sheets, hot rolled and cold finished bars, welded pipe, wire products, tinplate, and stainless. Still largely untouched were structurals, bar angles, floor plates, carbon plates, seamless pipe, oil country goods.

Undoubtedly the advent of freight absorption has focused attention of mills and consumers on shipping rates. But railroads and truckers have also been stirred to attention as pressure mounts to find the lowest possible method of shipment, and the truckers and railroads find themselves in a battle royal for the available business.

Indicative of this competition among the carriers are two recent developments, both of them involving railroads as they seek to regain business lost to the truckers.

First move by the roads came last Nov. 6 when new alternative freight rate mileage scales for iron and steel products moving in southern territory went into effect. Later that month the eastern railroads took similar action to bring into line with southern roads the rates on steel moving into southern territory.

Secondly, Traffic Executive Assn., eastern railroads, have come up with a proposed new scale of motor competitive rates to apply within the so-called Official Territory. A public hearing on the rates was to be held in Pittsburgh Jan. 5, at which time shippers were to give their views on the proposed changes. The proposed rates could be put into effect in about 30 days, maybe sooner should the railroads press the Interstate Commerce Commission for fast action.

A look at railroad freight rate increases in Official Territory since June 1946 indicates the growing importance of shipping costs to steel producer and consumer.

On July 1, 1946, rates were increased 11.3 pct, and on Jan. 1, 1947, were advanced to a total of 25 pct. Maximum on iron and steel products was 10¢ per cwt. On Oct. 13, 1947, another 10 pct increase went into effect; this was boosted to 20 pct on Jan. 5, 1948, and to a total of 30 pct on May 6, 1948. Maximum increase for iron and steel products was 16¢ per cwt.

Another freight boost came along on Jan. 11, 1949, one of 6 pct, being boosted to 10 pct on Sept. 1, 1949. Freight charges went up again on Apr. 4, 1951, with a 4 pct boost, increased to 9 pct on Aug. 28, 1951. On May 2, 1952, the rise was increased "temporarily" to a total of 15 pct. This was to have expired Feb. 28, 1954, but it looks as though it will be extended to Dec. 31, 1955.

In view of these increases, it is doubtful that freight absorption will regain former proportions.

## Iron Age Steel Freight Rate Compilation

**As a guide for steel consumers, The Iron Age has prepared the table facing this page of railroad freight rates from major producing areas to selected consuming points. The table is in no sense a tariff. The rates were obtained from railroads and others as a service in view of increasing importance of freight rates in today's more competitive steel market.**

the Iron Age

# IRON & STEEL FREIGHT RATES

| TO | Akron, Ohio | | Alabama City, Ala. | | Albany, N. Y. | | Alton, Ill. | | Anderson, Ind. | | Ashland, Ky. | | Atlanta, Ga. | | Baltimore, Md. | | Bethlehem, Pa. | | Birmingham, Ala. | | Boston, Mass. | | Buffalo, N. Y. | | Butler, Pa. | | Canton, Ohio | | Chicago, Ill. | | Cincinnati, Ohio | | Claymont, Del. | | Cleveland, Ohio | | Coatesville, Pa. | | Columbus, Ohio | | Conshohocken, Pa. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 |
| Alabama City, Ala. | | | | | | | 70* | 63 | | | 64* | 58 | 27* | 24 | | | 106 | | 19* | 17 | 110 | | 100 | | 98 | | 97 | | 92 | | 57* | 51 | 106 | | 97 | | 106 | | | | 106 | |
| Alton, Ill. | 68 | 56 | 70* | 63 | 89 | 86 | | | 48 | 34 | 67 | 54 | 77* | 69 | 86 | 83 | 88 | 85 | 62* | 56 | 97 | 94 | 77 | 71 | 75 | 65 | 68 | 56 | 42 | 30 | 53 | 38 | 88 | 85 | 68 | 56 | 72 | 62 | 61 | 46 | 88 | |
| Ashland, Ky. | 44 | 31 | 64* | 48 | 78 | 73 | | | 44 | 30½ | | | 66* | 59 | 67 | 54 | 72 | 62 | 70* | 63 | 87 | 84 | 62 | 48 | 53 | 38 | 43 | 30 | 58 | 44 | 36 | 23 | 72 | 62 | 46 | 33 | 70 | 59 | 34 | 21 | 72 | |
| Atlanta, Ga. | | | 27* | 24 | | | 77* | 69 | | | 66* | 59 | | | | | 101 | | 31* | 28 | 105 | | 101 | | 99 | | 98 | | 99 | | 62* | 56 | 101 | | 98 | | 101 | | | | 101 | |
| Bethlehem, Pa. | 63 | 52 | 98* | 88 | 42 | 31 | 88 | 85 | 77 | 71 | 72 | 62 | 93* | 84 | 38 | 27 | | | 101* | 91 | 53 | 41 | 54 | 42 | 54 | 42 | 62 | 50 | 81 | 77 | 75 | 65 | 24 | 17 | 63 | 52 | 24 | 17 | 68 | 56 | 20 | |
| Birmingham, Ala. | | | 19* | 17 | | | 62* | 58 | | | 70* | 63 | 31* | 28 | | | 114 | | | | 112 | | 101 | | 99 | | 98 | | 92 | | 64* | 58 | 114 | | 98 | | 114 | | | | 114 | |
| Buffalo, N. Y. | 43 | 29½ | 95* | 86 | 51 | 38 | 77 | 71 | 62 | 48 | 62 | 48 | 98* | 88 | 58 | 46 | 54 | 42 | 98* | 88 | 63 | 52 | | | 42 | 29 | 43 | 29½ | 67 | 54 | 61 | 46 | 61 | 48 | 40 | 27 | 57 | 44 | 52 | 37 | 58 | |
| Butler, Pa. | 33 | 20 | 88* | 77 | 67 | 54 | 75 | 65 | 53 | 38 | 51 | 34½ | 89* | 80 | 52 | 37 | 54 | 42 | 88* | 80 | 76 | 68 | 44 | 30½ | | | 33 | 20 | 63 | 51 | 51 | 35 | 54 | 42 | 34 | 21 | 52 | 40 | 40 | 27 | 54 | |
| Canton, Ohio | 12 | 7 | 81* | 73 | 68 | 56 | 68 | 56 | 44 | 31 | 44 | 30½ | 84* | 76 | 61 | 48 | 62 | 50 | 84* | 76 | 77 | 71 | 43 | 30 | 33 | 20½ | | | 54 | 40 | 44 | 30½ | 63 | 52 | 20 | 13 | 61 | 48 | 33 | 20½ | 62 | |
| Chicago, Ill. | 54 | 40 | 81* | 73 | 81 | 77 | 42 | 32 | 37 | 25 | 58 | 44 | 86* | 77 | 79 | 78 | 81 | 77 | 80* | 72 | 89 | 86 | 67 | 54 | 63 | 51 | 59 | 40 | | | 48 | 34 | 84 | 79 | 53 | 38 | 81 | 77 | 51 | 35 | 84 | |
| Claymont, Del. | 63 | 52 | 95* | 86 | 44 | 38 | 88 | 85 | 77 | 71 | 72 | 62 | 89* | 80 | 25 | 18½ | 24 | 17 | 98* | 88 | 54 | 42 | 61 | 48 | 54 | 42 | 62 | 50 | 84 | 79 | 75 | 65 | | | 67 | 54 | 14 | 10 | 68 | 56 | 12 | |
| Cleveland, Ohio | 14 | 8 | 81* | 73 | 63 | 62 | 68 | 56 | 44 | 31 | 46 | 32 | 84* | 76 | 62 | 50 | 63 | 52 | 84* | 76 | 76 | 68 | 40 | 27 | 34 | 21 | 20 | 13 | 53 | 38 | 44 | 30½ | 67 | 54 | | | 62 | 15 | 34 | 22 | 67 | |
| Coatesville, Pa. | 62 | 50 | 93* | 84 | 52 | 40 | 67 | 64 | 76 | 68 | 70 | 59 | 89* | 80 | 28 | 19 | 28 | 18½ | 98* | 88 | 57 | 44 | 57 | 44 | 53 | 41 | 61 | 48 | 81 | 77 | 72 | 62 | 14 | 10 | 62 | 50 | | | 67 | 54 | 14 | |
| Conshohocken, Pa. | 63 | 52 | 95* | 86 | 53 | 41 | 68 | 65 | 77 | 71 | 72 | 62 | 90* | 81 | 33 | 22 | 28 | 18½ | 100* | 90 | 53 | 41 | 58 | 46 | 54 | 42 | 62 | 50 | 84 | 79 | 75 | 65 | 12 | 9 | 67 | 54 | 14 | 10 | 68 | 56 | | |
| Detroit, Mich. | 40 | 26 | 83* | 75 | 68 | 56 | 63 | 51 | 43 | 30 | 52 | 37 | 86* | 77 | 72 | 62 | 72 | 62 | 86* | 77 | 78 | 73 | 44 | 30½ | 51 | 34½ | 42 | 28 | 48 | 33 | 46 | 32 | 76 | 68 | 37 | 25 | 75 | 65 | 40 | 27 | 75 | |
| Dover, Ohio | 18 | 11 | 81* | 73 | 68 | 56 | 68 | 56 | 46 | 32 | 43 | 29½ | 83* | 76 | 61 | 46 | 62 | 50 | 86* | 77 | 78 | 73 | 44 | 31 | 34 | 21 | 12 | 7 | 57 | 42 | 43 | 29½ | 62 | 50 | 25 | 18½ | 61 | 48 | 32 | 19 | 62 | |
| Fairfield, Ala. | | | | | 62* | 56 | | | | | 70* | 63 | 31* | 28 | | | 114 | | | | 112 | | 101 | | 99 | | 98 | | 92 | | 64* | 58 | 114 | | 98 | | 114 | | | | 114 | |
| Follansbee, W. Va. | 29 | 18 | 83* | 75 | 63 | 52 | 75 | 65 | 53 | 38 | 51 | 34½ | 86* | 77 | 52 | 40 | 54 | 42 | 87* | 78 | 76 | 68 | 44 | 30½ | 28 | 17 | 24 | 15 | 63 | 51 | 51 | 35 | 54 | 42 | 33 | 20½ | 52 | 40 | 40 | 27 | 54 | |
| Gary, Ind. | 54 | 40 | 81* | 73 | 81 | 77 | 42 | 34 | 34 | 25 | 58 | 44 | 86* | 77 | 79 | 75 | 81 | 77 | 80* | 72 | 89 | 86 | 67 | 54 | 63 | 51 | 59 | 40 | | | 48 | 34 | 84 | 79 | 53 | 38 | 81 | 77 | 51 | 35 | 84 | |
| Granite City, Ill. | 68 | 56 | 70* | 63 | 89 | 86 | | | 48 | 34 | 67 | 54 | 77* | 69 | 86 | 83 | 88 | 85 | 62* | 56 | 97 | 94 | 77 | 71 | 75 | 65 | 67 | 54 | 42 | 34 | 68 | 56 | 88 | 85 | 68 | 56 | 72 | 62 | 61 | 46 | 88 | |
| Harrisburg, Pa. | 57 | 44 | 90* | 81 | 48 | 37½ | 85 | 81 | 72 | 69 | 67 | 64 | 87* | 78 | 28 | 19 | 29 | 19½ | 95* | 88 | 62 | 50 | 52 | 40 | 46 | 36½ | 54 | 42 | 78 | 73 | 70 | 59 | 32 | 21 | 57 | 44 | 23 | 16 | 62 | 50 | 32 | |
| Hartford, Conn. | 75 | 65 | 113* | 102 | 36 | 23 | 92 | 89 | 84 | 79 | 84 | 79 | 107* | 96 | 52 | 41 | 44 | 35 | 115* | 104 | | | 61 | 48 | 70 | 59 | 75 | 65 | 87 | 84 | 84 | 79 | 44 | 36 | 72 | 62 | 46 | 36½ | 78 | 73 | 44 | |
| Houston, Tex. | | | 89 | | | | 90 | | | | 113 | | 95 | | | | 141 | | 84 | | 158 | | 131 | | 125 | | 120 | | 107 | | 107 | | 140 | | 113 | | 138 | | | | 140 | |
| Ind. Harbor, Ind. | 54 | 40 | 81* | 73 | 81 | 77 | 42 | 34 | 37 | 25 | 58 | 44 | 86* | 77 | 79 | 75 | 81 | 77 | 80* | 72 | 89 | 86 | 67 | 54 | 63 | 51 | 59 | 40 | | | 48 | 34 | 84 | 79 | 53 | 38 | 81 | 77 | 51 | 35 | 84 | |
| Johnstown, Pa. | 42 | 28 | 92* | 83 | 58 | 46 | 77 | 71 | 61 | 48 | 57 | 42 | 93* | 84 | 46 | 36½ | 48 | 37 | 95* | 86 | 72 | 62 | 44 | 31 | 28 | 17 | 40 | 26 | 68 | 56 | 57 | 42 | 48 | 37½ | 42 | 29 | 44 | 35 | 48 | 33 | 48 | |
| Kokomo, Ind. | 48 | 33 | 72* | 65 | 78 | 73 | 48 | 33 | 16 | 9 | 48 | 34 | 75* | 65 | 76 | 66 | 78 | 73 | 72* | 65 | 87 | 84 | 62 | 48 | 57 | 42 | 48 | 34 | 34 | 22 | 36 | 23 | 78 | 73 | 46 | 32 | 77 | 71 | 40 | 27 | 78 | |
| Los Angeles, Cal. | | | 191 | | | | 165 | | | | 191 | | | | | | 191 | | | | 191 | | 191 | | 191 | | 191 | | 167 | | 191 | | 191 | | 191 | | | | 191 | |
| Mansfield, Ohio | 23 | 14 | 77* | 69 | 70 | 59 | 63 | 51 | 40 | 27 | 42 | 28 | 80* | 72 | 67 | 54 | 66 | 56 | 80* | 72 | 78 | 73 | 46 | 32 | 40 | 26 | 24 | 15 | 51 | 35 | 40 | 26 | 68 | 56 | 25 | 16 | 68 | 54 | 24 | 15 | 68 | |
| Massillon, Ohio | 12 | 7½ | 81* | 73 | 68 | 56 | 66 | 56 | 44 | 31 | 44 | 30½ | 84* | 76 | 61 | 46 | 62 | 50 | 84* | 76 | 77 | 71 | 43 | 30 | 53 | 38 | 7 | 5½ | 54 | 40 | 44 | 30½ | 63 | 52 | 20 | 13 | 61 | 48 | 33 | 20½ | 62 | |
| Middletown, Ohio | 44 | 31 | 66* | 54 | 77 | 71 | 54 | 40 | 32 | 19 | 36 | 24 | 70* | 63 | 70 | 59 | 75 | 65 | 70* | 63 | 85* | 81 | 58 | 44 | 52 | 37 | 43 | 29½ | 48 | 33 | 14 | 8 | 75 | 65 | 42 | 29 | 72 | 62 | 28 | 17 | 75 | |
| Midland, Pa. | 28 | 17 | 86* | 77 | 63 | 52 | 75 | 65 | 53 | 38 | 51 | 34½ | 89* | 80 | 52 | 40 | 54 | 42 | 89* | 80 | 76 | 68 | 44 | 30½ | 20 | 13 | 22 | 13½ | 63 | 51 | 51 | 35 | 54 | 42 | 33 | 20 | 52 | 40 | 40 | 27 | 54 | |
| Minnequa, Colo. | | | 141 | | | | 121 | | | | 143 | | 145 | | | | 162 | | 137 | | 169 | | 149 | | 146 | | 142 | | 130 | | 136 | | 162 | | 141 | | 160 | | | | 162 | |
| Morrisville, Pa. | | | 97* | 87 | | | 89 | 86 | | | 75 | 66 | 92* | 83 | | | 23 | 16 | 100* | 90 | 52 | 40 | 58 | 46 | 58 | 46 | 63 | 52 | 84 | 79 | 76 | 68 | 15 | 11½ | 68 | 56 | 20 | 14 | | | 14 | |
| Newark, N. J. | | | 101* | 91 | | | 91 | 88 | | | 77 | 71 | 97* | 87 | | | 25 | 18 | 107* | 98 | 51 | 38 | 58 | 46 | 62 | 50 | 70 | 59 | 86 | 83 | 78 | 73 | 33 | 22 | 70 | 59 | 34 | 24 | | | 32 | |
| New Haven, Conn. | 75 | 65 | 111* | 100 | 40 | 25 | 94 | 91 | 86 | 81 | 81 | 77 | 103* | 93 | 61 | 39 | 42 | 31 | 113* | 102 | | | 61 | 48 | 68 | 56 | 75 | 65 | 87 | 84 | 84 | 79 | 42 | 32 | 72 | 62 | 43 | 34 | 78 | 73 | 42 | |
| Niles, Cal. | | | 191 | | | | 165 | | | | 191 | | 191 | | | | 191 | | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 191 | | 191 | | 191 | | 191 | | | | 191 | |
| Niles, Ohio | 15 | 10 | 86* | 77 | 63 | 51 | 72 | 62 | 52 | 37 | 51 | 35 | 89* | 80 | 57 | 42 | 61 | 48 | 89* | 80 | 76 | 68 | 40 | 26 | 23 | 14 | 18 | 11 | 58 | 44 | 51 | 35 | 61 | 48 | 20 | 13 | 57 | 44 | 40 | 26 | 57 | |
| Phoenixville, Pa. | 62 | 44 | 95* | 86 | 53 | 41 | 88 | 85 | 77 | 71 | 72 | 62 | 90* | 81 | 33 | 23 | 25 | 18½ | 100* | 90 | 54 | 42 | 57 | 44 | 53 | 41 | 82 | 50 | 81 | 77 | 75 | 65 | 14 | 10 | 63 | 52 | 12 | 8½ | 68 | 56 | 9 | |
| Pittsburg, Cal. | | | 191 | | | | 165 | | | | 191 | | 191 | | | | 191 | | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 191 | | 191 | | 191 | | 191 | | | | 191 | |
| Pittsburgh, Pa. | 33 | 20 | 86* | 77 | 63 | 52 | 77 | 65 | 53 | 38 | 51 | 34½ | 89* | 80 | 52 | 40 | 58 | 46 | 89* | 80 | 76 | 68 | 44 | 30½ | 15 | 10 | 32 | 19 | 63 | 51 | 51 | 35 | 54 | 42 | 34 | 22 | 52 | 40 | 40 | 27 | 54 | |
| Portsmouth, Ohio | 44 | 31 | 64* | 58 | 78 | 73 | 63 | 51 | 44 | 30½ | 18 | 11 | 86* | 69 | 67 | 54 | 72 | 62 | 70* | 63 | 87 | 84 | 62 | 48 | 53 | 38 | 43 | 30 | 58 | 44 | 33 | 20 | 72 | 62 | 48 | 33 | 86 | 83 | 32 | 18½ | 72 | |
| San Francisco, Cal. | | | 191 | | | | 165 | | | | 191 | | 191 | | | | 191 | | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 191 | | 191 | | 191 | | 191 | | | | 191 | |
| Seattle, Wash. | | | 191 | | | | 165 | | | | 191 | | 191 | | | | 191 | | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 191 | | 191 | | 191 | | 191 | | | | 191 | |
| Sharon, Pa. | 22 | 13½ | 88* | 77 | 63 | 52 | 72 | 62 | 52 | 37 | 51 | 35 | 89* | 80 | 57 | 34 | 61 | 48 | 89* | 80 | 76 | 68 | 40 | 26 | 20 | 13 | 23 | 14 | 58 | 44 | 51 | 35 | 61 | 48 | 25 | 16 | 57 | 44 | 40 | 26 | 61 | |
| Sparrows Pt., Md. | 81 | 48 | 87* | 78 | 53 | 41 | 86 | 63 | 75 | 65 | 67 | 54 | 83* | 75 | | | 36 | 27 | 92* | 83 | 82 | 50 | 58 | 46 | 53 | 41 | 61 | 48 | 79 | 75 | 70 | 59 | 25 | 18½ | 62 | 50 | 29 | 19 | 63 | 52 | 38 | |
| Sterling, Ill. | 63 | 51 | 84* | 76 | 86 | 83 | 37 | 29½ | 48 | 34 | 68 | 56 | 87* | 78 | 86 | 83 | 87 | 84 | 81* | 73 | 92 | 89 | 77 | 71 | 70 | 59 | 63 | 51 | 24 | 20 | 57 | 42 | 87 | 84 | 62 | 48 | 86 | 83 | 61 | 46 | 87 | |
| St. Louis, Mo. | | | 70* | 63 | | | | | | | 67 | 54 | 77* | 69 | | | 88 | 65 | 62* | 56 | 97 | 94 | 77 | 71 | 75 | 65 | 68 | 56 | 42 | 34 | 53 | 38 | 88 | 85 | 68 | 56 | 72 | 62 | | | 88 | |
| Torrance, Cal. | | | 191 | | | | 165 | | | | 191 | | 191 | | | | 191 | | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 191 | | 191 | | 191 | | 191 | | | | 191 | |
| Trenton, N. J. | 67 | 54 | 97* | 87 | 42 | 31 | 89 | 86 | 78 | 73 | 75 | 65 | 92* | 83 | 34 | 24 | 22 | 15 | 100* | 90 | 52 | 40 | 58 | 46 | 58 | 46 | 63 | 52 | 84 | 79 | 76 | 68 | 15 | 11½ | 68 | 58 | 20 | 14 | 70 | 59 | 15 | |
| Weirton, W. Va. | 28 | 18 | 83 | 75 | 63 | 52 | 75 | 65 | 53 | 38 | 51 | 34½ | 86* | 77 | 52 | 40 | 54 | 42 | 87* | 78 | 78 | 68 | 44 | 30½ | 25 | 16½ | 23 | 14 | 63 | 51 | 51 | 35 | 54 | 42 | 33 | 20½ | 52 | 40 | 40 | 27 | 54 | |
| Wheeling, W. Va. | 32 | 19 | 83 | 75 | 63 | 52 | 75 | 65 | 53 | 38 | 51 | 34½ | 86* | 77 | 52 | 40 | 54 | 42 | 87* | 78 | 76 | 68 | 44 | 30½ | 33 | 20 | 23 | 14 | 63 | 51 | 51 | 35 | 54 | 42 | 34 | 22 | 52 | 40 | 40 | 27 | 54 | |
| Worcester, Mass. | | | 117* | 105 | | | 94 | 91 | | | 85 | 81 | 113* | 102 | | | 51 | 39 | 120* | 108 | | | 62 | 50 | 75 | 65 | 76 | 68 | 87 | 84 | 85 | 81 | 52 | 40 | 75 | 65 | 53 | 41 | | | 52 | |
| Youngstown, Ohio | 19 | 12 | 86* | 77 | 63 | 52 | 72 | 62 | 52 | 37 | 51 | 35 | 89* | 80 | 57 | 44 | 61 | 48 | 86* | 80 | 76 | 68 | 40 | 26 | 20 | 13 | 19 | 12 | 58 | 44 | 51 | 35 | 61 | 48 | 23 | 14 | 57 | 44 | 40 | 26 | 61 | |

* Shipments to points marked with asterisk (*) are not subject to 15 pct increase under Ex Parte 175-B.

† Minimum carload weight 36,000 lb.

Figures (40) and (80) at top of columns denote 40,000 and 80,000-lb minimum carload weights.

| Claymont, Del. | | Cleveland, Ohio | | Coatesville, Pa. | | Columbus, Ohio | | Conshohocken, Pa. | | Dayton, Ohio | | Detroit, Mich. | | Dover, Ohio | | Duluth, Minn. | | Erie, Pa. | | Evansville, Ind. | | Fairfield, Ala. | | Flint, Mich. | | Follansbee, W. Va. | | Fontana, Cal. | | Fort Wayne, Ind. | | Gary, Ind. | | Geneva, Utah | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 |
| 106 | | 97 | | 106 | | | | 106 | | | | 97 | | 97 | | 114 | | | | | | 19° | 17 | | | 98 | | 158 | | | | 92 | | 158 | |
| 88 | 85 | 68 | 56 | 72 | 62 | 61 | 46 | 88 | 85 | 54 | 40 | 63 | 51 | 68 | 56 | 81 | | 75 | 65 | 37 | 25 | 62° | 56 | 67 | 54 | 72 | 62 | 141 | | 53 | 38 | 42 | 32 | 141 | |
| 72 | 62 | 48 | 33 | 70 | 59 | 34 | 21 | 72 | 62 | 36 | 23 | 52 | 37 | 42 | 29 | 88 | | 54 | 40 | 57 | 42 | 70° | 63 | 54 | 40 | 44 | 31 | 167 | | 48 | 33 | 58 | 44 | | |
| 101 | | 98 | | 101 | | | | 101 | | | | 99 | | 98 | | 117 | | | | | | 31° | 28 | | | 99 | | 167 | | | | 99 | | | |
| 24 | 17 | 63 | 52 | 24 | 17 | 66 | 56 | 20 | 14 | 72 | 62 | 72 | 62 | 62 | 50 | 99 | | 58 | 46 | 65 | 61 | 101° | 91 | 72 | 62 | 184 | | 184 | | 76 | 68 | 81 | 77 | 207 | |
| 114 | | 98 | | 114 | | | | 114 | | | | 99 | | 98 | | 112 | | | | | | | | | | 99 | | 158 | | | | 92 | | 158 | |
| 61 | 48 | 40 | 27 | 57 | 44 | 52 | 37 | 58 | 46 | 57 | 42 | 44 | 30½ | 44 | 31 | 87 | | 28 | 17 | 75 | 65 | 98° | 88 | 46 | 32 | 46 | 32 | 167 | | 57 | 42 | 67 | 54 | 192 | |
| 54 | 42 | 34 | 21 | 52 | 40 | 40 | 27 | 54 | 42 | 46 | 32 | 51 | 35 | 34 | 21 | 89 | | 33 | 20½ | 68 | 56 | 89° | 80 | 53 | 38 | 29 | 18 | 167 | | 52 | 37 | 63 | 51 | 191 | |
| 63 | 52 | 20 | 13 | 61 | 48 | 33 | 20½ | 62 | 50 | 40 | 27 | 40 | 27 | 12 | 7 | 88 | | 34 | 22 | 63 | 51 | 84° | 76 | 44 | 30½ | 25 | 18 | 167 | | 42 | 29 | 54 | 40 | 186 | |
| 84 | 79 | 53 | 38 | 81 | 77 | 51 | 35 | 84 | 79 | 44 | 31 | 48 | 33 | 57 | 42 | 69 | | 62 | 48 | 44† | 34½ | 80° | 72 | 44 | 31 | 61 | 48 | 148 | | 36 | 23 | | | 148 | |
| | | 67 | 54 | 14 | 10 | 68 | 56 | 12 | 9 | 75 | 65 | 76 | 68 | 62 | 50 | 101 | | 62 | 50 | 85 | 81 | 98° | 88 | 77 | 71 | 61 | 48 | 184 | | 76 | 68 | 84 | 79 | 207 | |
| 67 | 54 | | | 62 | 15 | 34 | 22 | 67 | 54 | 40 | 27 | 37 | 25 | 25 | 16½ | 85 | | 29 | 17 | 62 | 48 | 84° | 78 | 42 | 29 | 33 | 20½ | 167 | | 40 | 27 | 53 | 38 | 185 | |
| 14 | 10 | 62 | 50 | | | 67 | 54 | 14 | 10 | 72 | 62 | 75 | 65 | 61 | 48 | | | 61 | 48 | 84 | 79 | 98° | 88 | 75 | 65 | 57 | 44 | 184 | | 75 | 65 | 81 | 77 | 205 | |
| 12 | 9 | 67 | 54 | 14 | 10 | 68 | 56 | | | 75 | 65 | 62 | 50 | 101 | | 61 | 48 | 85 | 81 | 100° | 90 | 76 | 68 | 58 | 46 | 184 | | 76 | 68 | 84 | 79 | 207 | |
| 78 | 68 | 37 | 25 | 75 | 65 | 40 | 27 | 75 | 65 | 42 | 28 | | | 42 | 29 | 76 | | 46 | 32 | 62 | 48 | 86° | 77 | 22 | 13½ | 46 | 32 | 158 | | 36 | 23 | 48 | 33 | 182 | |
| 62 | 50 | 25 | 16½ | 61 | 48 | 32 | 19 | 62 | 50 | 40 | 26 | 42 | 29 | | | 86 | | 36 | 24 | 62 | 48 | 86° | 77 | 44 | 31 | 23 | 14 | 167 | | 43 | 29½ | 57 | 42 | 187 | |
| 114 | | 98 | | 114 | | | | 114 | | | | 99 | | 98 | | 112 | | | | | | | | | | 99 | | 158 | | | | 92 | | 158 | |
| 54 | 42 | 33 | 20½ | 52 | 40 | 40 | 27 | 54 | 42 | 46 | 32 | 51 | 35 | 23 | 14 | 88 | | 37 | 25 | 69 | 56 | 87° | 78 | 53 | 38 | | | 167 | | 62 | 37 | 63 | 51 | 189 | |
| 84 | 79 | 53 | 38 | 81 | 77 | 51 | 35 | 84 | 79 | 44 | 31 | 48 | 33 | 57 | 42 | 69 | | 62 | 48 | 44† | 34½ | 80° | 72 | 44 | 31 | 61 | 46 | 148 | | 32† | 23 | | | 148 | |
| 88 | 85 | 68 | 56 | 72 | 62 | 61 | 46 | 88 | 85 | 54 | 40 | 63 | 51 | 68 | 56 | 82 | | 75 | 65 | 37 | 25 | 62° | 56 | 67 | 54 | 72 | 62 | 141 | | 53 | 38 | 42 | 34 | 141 | |
| 32 | 21 | 57 | 44 | 23 | 16 | 62 | 50 | 32 | 10 | 68 | 56 | 70 | 59 | 54 | 40 | 98 | | 53 | 41 | 81 | 77 | 95° | 88 | 72 | 62 | 52 | 40 | 184 | | 68 | 56 | 78 | 73 | 203 | |
| 44 | 38 | 72 | 62 | 48 | 38½ | 78 | 73 | 44 | 35 | 81 | 77 | 78 | 68 | 78 | 68 | 101 | | 67 | 54 | 90 | 87 | 115° | 104 | 78 | 68 | 75 | 65 | 184 | | 81 | 77 | 87 | 84 | 211 | |
| 140 | | 119 | | 138 | | | | 140 | | | | 117 | | 119 | | 125 | | | | | | 84 | | | | 122 | | 135 | | | | 107 | | 125 | |
| 84 | 79 | 53 | 38 | 81 | 77 | 51 | 35 | 84 | 79 | 58 | 44 | 48 | 33 | 67 | 42 | 99 | | 62 | 48 | 61 | 34½ | 80° | 72 | 44 | 31 | 61 | 46 | 148 | | 38 | 23 | | | 148 | |
| 48 | 37½ | 42 | 29 | 44 | 35 | 48 | 33 | 48 | 37½ | 53 | 38 | 57 | 42 | 40 | 29 | 93 | | 42 | 29 | 75 | 65 | 95° | 86 | 61 | 46 | 34 | 21 | 184 | | 58 | 44 | 68 | 56 | 194 | |
| 78 | 73 | 46 | 32 | 77 | 71 | 40 | 27 | 78 | 73 | 34 | 21 | 43 | 29½ | 81 | 34½ | 80 | | 64 | 40 | 43 | 29½ | 72° | 62 | 46 | 32 | 53 | 38 | 158 | | 25 | 16 | 34 | 22 | 174 | |
| 191 | | 191 | | 191 | | | | 191 | | | | 191 | | 191 | | 168 | | | | | | 191 | | | | 191 | | | | | | 167 | | | |
| 68 | 56 | 25 | 16 | 68 | 54 | 24 | 15 | 68 | 56 | 33 | 20½ | 36 | 23 | 25 | 16½ | 83 | | 40 | 26 | 58 | 44 | 80° | 72 | 40 | 27 | 36 | 23 | 167 | | 36 | 23 | 51 | 35 | 183 | |
| 63 | 52 | 20 | 13 | 61 | 48 | 33 | 20½ | 62 | 50 | 40 | 27 | 40 | 27 | 12 | 7 | 86 | | 34 | 22 | 63 | 51 | 84° | 76 | 44 | 30½ | 25 | 16 | 167 | | 42 | 29 | 54 | 40 | 186 | |
| 75 | 65 | 42 | 29 | 72 | 62 | 28 | 17 | 75 | 65 | 12 | 7 | 43 | 29½ | 42 | 29 | 85 | | 51 | 35 | 48 | 33 | 76° | 63 | 48 | 37 | 44 | 31 | 158 | | 34 | 22 | 48 | 33 | 180 | |
| 54 | 42 | 33 | 20 | 52 | 40 | 40 | 27 | 54 | 42 | 46 | 32 | 51 | 35 | 24 | 15 | 89 | | 34 | 22 | 68 | 56 | 89° | 80 | 53 | 38 | 15 | 9 | 167 | | 52 | 37 | 63 | 51 | 191 | |
| 162 | | 141 | | 160 | | | | 162 | | | | 138 | | 142 | | 132 | | | | | | 137 | | | | 144 | | 120 | | | | 130 | | 120 | |
| 15 | 11½ | 68 | 56 | 20 | 14 | | | 14 | 10 | | | 75 | 65 | 63 | 52 | 101 | | | | | | 100° | 90 | | | 62 | 48 | 184 | | | | 84 | 79 | 208 | |
| 33 | 22 | 70 | 59 | 34 | 24 | | | 32 | 21 | | | 75 | 65 | 68 | 58 | 101 | | | | | | 107° | 96 | | | 67 | 54 | 184 | | | | 86 | 83 | 211 | |
| 42 | 32 | 72 | 62 | 43 | 34 | 78 | 73 | 42 | 31 | 81 | 77 | 76 | 68 | 75 | 65 | 101 | | 68 | 56 | 91 | 88 | 112° | 102 | 77 | 71 | 72 | 62 | 184 | | 81 | 77 | 87 | 84 | 211 | |
| 191 | | 191 | | 191 | | | | 191 | | | | 191 | | 191 | | 165 | | | | | | 191 | | | | 191 | | | | | | 167 | | | |
| 61 | 48 | 20 | 13 | 57 | 44 | 40 | 26 | 57 | 44 | 44 | 30½ | 43 | 30 | 23 | 14 | 87 | | 29 | 18 | 65 | 56 | 89° | 80 | 48 | 34 | 29 | 18 | 167 | | 44 | 31 | 58 | 44 | 187 | |
| 14 | 10 | 63 | 52 | 12 | 8½ | 68 | 56 | 9 | 6½ | 72 | 62 | 75 | 65 | 62 | 50 | 101 | | 61 | 48 | 85 | 81 | 100° | 90 | 75 | 65 | 58 | 46 | 184 | | 76 | 68 | 81 | 77 | 207 | |
| 191 | | 191 | | 191 | | | | 191 | | | | 191 | | 191 | | 165 | | | | | | 191 | | | | 191 | | | | | | 167 | | | |
| 54 | 42 | 34 | 22 | 52 | 40 | 40 | 27 | 54 | 42 | 46 | 32 | 51 | 35 | 32 | 18½ | 89 | | 36 | 23 | 68 | 56 | 89° | 80 | 53 | 48 | 18 | 11 | 167 | | 52 | 37 | 63 | 51 | 191 | |
| 72 | 62 | 48 | 33 | 86 | 83 | 32 | 18½ | 72 | 62 | 34 | 21 | 52 | 37 | 42 | 29 | 88 | | 54 | 40 | 57 | 42 | 70° | 63 | 54 | 40 | 44 | 30½ | 167 | | 48 | 33 | 58 | 44 | 185 | |
| 191 | | 191 | | 191 | | | | 191 | | | | 191 | | 191 | | 165 | | | | | | 191 | | | | 191 | | | | | | 167 | | | |
| 191 | | 191 | | 191 | | | | 191 | | | | 191 | | 191 | | 165 | | | | | | 191 | | | | 191 | | | | | | 167 | | | |
| 61 | 48 | 25 | 16 | 57 | 44 | 40 | 26 | 61 | 48 | 44 | 30½ | 43 | 30 | 29 | 18 | 87 | | 25 | 16 | 68 | 56 | 89° | 80 | 48 | 34 | 29 | 18 | 167 | | 44 | 31 | 58 | 44 | 187 | |
| 25 | 18½ | 62 | 50 | 29 | 19 | 63 | 52 | 33 | 22 | 68 | 56 | 72 | 62 | 61 | 48 | 100 | | 61 | 48 | 81 | 77 | 92° | 83 | 76 | 68 | 54 | 40 | 184 | | 75 | 65 | 79 | 75 | 205 | |
| 87 | 84 | 62 | 48 | 86 | 83 | 61 | 46 | 87 | 84 | 54 | 40 | 57 | 42 | 63 | 51 | 65 | | 70 | 59 | 53 | 38 | 81° | 73 | 54 | 40 | 68 | 56 | 148 | | 46 | 32 | 24 | 29 | 148 | |
| 38 | 85 | 68 | 56 | 72 | 62 | | | 88 | 85 | | | 63 | 51 | 68 | 56 | 82 | | | | | | 82° | 56 | | | 72 | 62 | 141 | | | | 42 | 34 | 141 | |
| 191 | | 191 | | 191 | | | | 191 | | | | 191 | | 167 | | 191 | | | | | | 191 | | | | 191 | | | | | | 167 | | | |
| 15 | 11½ | 68 | 56 | 20 | 14 | 70 | 59 | 15 | 11 | 75 | 65 | 75 | 65 | 63 | 52 | 101 | | 62 | 50 | 86 | 83 | 100° | 90 | 76 | 68 | 62 | 50 | 184 | | 77 | 71 | 84 | 79 | 208 | |
| 54 | 42 | 33 | 20½ | 52 | 40 | 40 | 27 | 54 | 42 | 46 | 32 | 51 | 35 | 22 | 13 | 88 | | 37 | 25 | 68 | 58 | 87° | 78 | 53 | 38 | 7 | 5½ | 167 | | 52 | 37 | 63 | 51 | 189 | |
| 54 | 42 | 34 | 22 | 52 | 40 | 40 | 27 | 54 | 42 | 46 | 32 | 51 | 35 | 29 | 18 | 89 | | 40 | 27 | 68 | 56 | 87° | 78 | 53 | 38 | 10 | 6½ | 167 | | 52 | 37 | 63 | 51 | 189 | |
| 52 | 40 | 75 | 65 | 53 | 41 | | | 52 | 40 | | | 77 | 71 | 77 | 71 | 105 | | | | | | 120° | 108 | | | 77 | 71 | 184 | | | | 87 | 84 | 215 | |
| 81 | 48 | 23 | 14 | 57 | 44 | 40 | 26 | 61 | 48 | 44 | 30½ | 43 | 30 | 25 | 16 | 87 | | 28 | 17 | 68 | 58 | 89° | 80 | 48 | 34 | 20 | 17 | 167 | | 44 | 31 | 58 | 44 | 187 | |

## Carload rates in cents per 100 lb

**All rates except those marked with asterisk (*) are subject to 15 pct increase on total freight charges (Ex Parte 175-B). Federal tax of 3 pct is also added to total freight bill.**

| Geneva, Utah | | Grand Rapids, Mich. | | Granite City, Ill. | | Harrisburg, Pa. | | Hartford, Conn. | | Houston, Tex. | | Indiana Harbor, Ind. | | Indianapolis, Ind. | | Johnstown, Pa. | | Kansas City, Mo. | | Kokomo, Ind. | | Lancaster, Pa. | | Lansing, Mich. | | Los Angeles, Cal. | | TO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | FROM |
| | 158 | | | | 70 | 63 | 101 | | 100 | | 89 | | 92 | | 88 | | 100 | | 101 | | 89 | | | | | | 158 | | Alabama City, Ala. |
| 82 | 141 | | 61 | 46 | 12 | | 85 | 81 | 94 | 91 | 90 | 70 | 42 | 32 | 44 | 30½ | 77 | 71 | 52 | | 48 | 33 | 86 | 83 | 62 | 46 | 141 | | Alton, Ill. |
| 84 | | | 61 | 46 | 63 | 51 | 67 | 54 | 84 | 79 | 113 | 105 | 58 | 44 | 44 | 31 | 54 | 40 | 85 | | 48 | 34 | 75 | 65 | 54 | 40 | 167 | | Ashland, Ky. |
| | | | | | 77* | 69 | 97 | | 105 | | 95 | | 99 | | 94 | | 99 | | 105 | | 96 | | | | | | 167 | | Atlanta, Ga. |
| 77 | 207 | | 78 | 73 | 88 | 85 | 29 | 19½ | 43 | 34 | 141 | 114 | 81 | 77 | 79 | 75 | 48 | 37 | 101 | | 78 | 73 | 25 | 18 | 78 | 68 | 184 | | Bethlehem, Pa. |
| | 158 | | | | 62* | 56 | 103 | | 112 | | 84 | | 92 | | 88 | | 101 | | 98 | | 88 | | | | | | 158 | | Birmingham, Ala. |
| 84 | 192 | | 57 | 42 | 77 | 71 | 52 | 40 | 61 | 48 | 131 | 105 | 67 | 54 | 63 | 51 | 44 | 31 | 92 | | 62 | 48 | 54 | 42 | 52 | 37 | 167 | | Buffalo, N. Y. |
| 51 | 191 | | 58 | 44 | 75 | 65 | 44 | 38 | 70 | 59 | 125 | 105 | 63 | 51 | 57 | 42 | 28 | 17 | 88 | | 57 | 42 | 51 | 34½ | 54 | 40 | 167 | | Butler, Pa. |
| 40 | 186 | | 51 | 35 | 68 | 56 | 54 | 42 | 76 | 65 | 120 | 105 | 54 | 40 | 51 | 34½ | 40 | 28 | 85 | | 48 | 34 | 58 | 46 | 44 | 30½ | 167 | | Canton, Ohio |
| | 148 | | 40 | 28 | 42 | 34 | 78 | 73 | 87 | 84 | 107 | 88 | | | 40 | 27 | 68 | 56 | 65 | | 34 | 22 | 79 | 75 | 42 | 28 | 148 | | Chicago, Ill. |
| 79 | 207 | | 79 | 75 | 88 | 85 | 32 | 21 | 44 | 36 | 140 | 114 | 84 | 79 | 78 | 73 | 48 | 37½ | 101 | | 78 | 73 | 23 | 18 | 77 | 71 | 184 | | Claymont, Del. |
| 38 | 185 | | 48 | 34 | 68 | 56 | 57 | 44 | 72 | 62 | 119 | 105 | 53 | 38 | 51 | 34½ | 42 | 29 | 85 | | 46 | 32 | 61 | 48 | 43 | 29½ | 167 | | Cleveland, Ohio |
| 77 | 205 | | 78 | 73 | 87 | 84 | 23 | 16 | 48 | 36½ | 138 | 114 | 81 | 77 | 77 | 71 | 44 | 35 | 100 | | 77 | 71 | 15 | 11½ | 76 | 63 | 184 | | Coatesville, Pa. |
| 79 | 207 | | 79 | 75 | 88 | 85 | 32 | 20 | 44 | 35 | 140 | 114 | 84 | 79 | 78 | 73 | 48 | 37 | 101 | | 78 | 73 | 22 | 15 | 77 | 71 | 184 | | Conshohocken, Pa. |
| 33 | 182 | | 36 | 24 | 63 | 51 | 70 | 59 | 76 | 68 | 117 | 105 | 48 | 33 | 48 | 33 | 57 | 42 | 82 | | 43 | 29½ | 72 | 62 | 28 | 17 | 158 | | Detroit, Mich. |
| 42 | 187 | | 52 | 37 | 68 | 56 | 54 | 42 | 76 | 68 | 119 | 105 | 57 | 42 | 51 | 34½ | 40 | 27 | 85 | | 51 | 34½ | 58 | 44 | 46 | 32 | 167 | | Dover, Ohio |
| | 158 | | | | 62* | 56 | 103 | | 112 | | 84 | | 92 | | 86 | | 101 | | 98 | | 88 | | | | | | 158 | | Fairfield, Ala. |
| 81 | 189 | | 58 | 44 | 75 | 65 | 44 | 36 | 70 | 59 | 122 | 105 | 63 | 61 | 57 | 42 | 34 | 21 | 86 | | 57 | 42 | 51 | 38 | 54 | 40 | 167 | | Follansbee, W. Va. |
| | 148 | | 40 | 28 | 42 | 34 | 78 | 73 | 87 | 84 | 107 | 88 | | | 40 | 72 | 68 | 56 | 65 | | 34 | 22 | 79 | 75 | 42 | 28 | 148 | | Gary, Ind. |
| 34 | 141 | | 61 | 46 | | | 85 | 61 | 94 | 91 | 90 | 70 | 42 | 34 | 44 | 30½ | 77 | 71 | 52 | | 48 | 33 | 86 | 83 | 62 | 48 | 141 | | Granite City, Ill. |
| 73 | 203 | | 76 | 66 | 85 | 81 | | | | | 135 | 110 | 78 | 73 | 75 | 65 | 37 | 28 | 98 | | 75 | 65 | 15 | 11 | 72 | 62 | 184 | | Harrisburg, Pa. |
| 84 | 211 | | 91 | 77 | 94 | 91 | 53 | 41 | | | 152 | | 87 | 84 | 88 | 83 | 67 | 54 | 106 | | 85 | 81 | 51 | 39 | 78 | 73 | 184 | | Hartford, Conn. |
| | 125 | | | | 90 | | 135 | | 152 | | | | 107 | | 102 | | 129 | | 87 | | 105 | | | | | | 135 | | Houston, Tex. |
| | 148 | | 40 | 28 | 42 | 34 | 78 | 73 | 87 | 84 | 107 | 88 | | | 40 | 27 | 68 | 56 | 65 | | 34 | 22 | 79 | 75 | 42 | 28 | 148 | | Ind. Harbor, Ind. |
| 56 | 194 | | 67 | 54 | 77 | 71 | 37 | 28 | 67 | 54 | 129 | 108 | 68 | 56 | 62 | 48 | | | 92 | | 62 | 48 | 42 | 32 | 61 | 48 | 184 | | Johnstown, Pa. |
| 22 | 174 | | 42 | 28 | 48 | 33 | 75 | 65 | 85 | 61 | 105 | 88 | 34 | 22 | 19 | 12 | 62 | 48 | 99 | | | | 76 | 68 | 42 | 29 | 168 | | Kokomo, Ind. |
| | | | | | 165 | | 191 | | 191 | | 165 | | 167 | | 191 | | 191 | | 165 | | 191 | | | | | | | | Los Angeles, Cal. |
| 35 | 183 | | 46 | 32 | 63 | 51 | 91 | 48 | 76 | 66 | 116 | 105 | 61 | 35 | 43 | 29½ | 44 | 31 | 82 | | 42 | 29 | 63 | 52 | 42 | 28 | 167 | | Mansfield, Ohio |
| 40 | 186 | | 51 | 35 | 68 | 56 | 54 | 42 | 75 | 65 | 120 | 105 | 64 | 40 | 51 | 34½ | 40 | 26 | 85 | | 48 | 34 | 58 | 44 | 44 | 30½ | 167 | | Massillon, Ohio |
| 33 | 180 | | 48 | 37½ | 54 | 40 | 66 | 56 | 81 | 77 | 108 | 94 | 48 | 33 | 33 | 20½ | 54 | 40 | 75 | | 34 | 22 | 70 | 59 | 44 | 36 | 158 | | Middletown, Ohio |
| 51 | 191 | | 58 | 44 | 75 | 65 | 44 | 36 | 70 | 59 | 125 | 105 | 63 | 51 | 57 | 42 | 33 | 20½ | 88 | | 57 | 42 | 51 | 38 | 54 | 40 | 167 | | Midland, Pa. |
| | 120 | | | | 121 | | 157 | | 168 | | 99 | | 130 | | 132 | | 150 | | 105 | | 132 | | | | | | 120 | | Minnequa, Colo. |
| 79 | 208 | | | | 89 | 66 | 34 | 24 | 42 | 32 | 141 | 118 | 84 | 79 | 79 | 75 | 51 | 39 | 102 | | 79 | 75 | | | | | 184 | | Morrisville, Pa. |
| 83 | 211 | | | | 91 | 66 | 40 | 30 | 40 | 29 | 114 | 118 | 66 | 63 | 81 | 77 | 54 | 42 | 104 | | 84 | 79 | | | | | 184 | | Newark, N. J. |
| 84 | 211 | | 61 | 77 | 94 | 91 | 51 | 38 | 20 | 11 | 150 | 128 | 87 | 84 | 66 | 63 | 63 | 52 | 106 | | 85 | 81 | 48 | 36½ | 78 | 73 | 184 | | New Haven, Conn. |
| | | | | | 165 | | 191 | | 191 | | 165 | | 167 | | 191 | | 191 | | 165 | | 191 | | | | | | | | Niles, Cal. |
| 44 | 187 | | 53 | 38 | 72 | 62 | 52 | 40 | 72 | 62 | 123 | 105 | 58 | 44 | 53 | 38 | 36 | 24 | 86 | | 52 | 37 | 54 | 40 | 48 | 34 | 167 | | Niles, Ohio |
| 77 | 207 | | 78 | 73 | 87 | 84 | 25 | 18½ | 44 | 38 | 140 | 114 | 81 | 77 | 77 | 71 | 46 | 36½ | 101 | | 77 | 71 | 20 | 14 | 77 | 71 | 184 | | Phoenixville, Pa. |
| | | | | | 165 | | 191 | | 191 | | 165 | | 191 | | 167 | | 191 | | 165 | | 191 | | | | | | | | Pittsburg, Cal. |
| 51 | 191 | | 58 | 44 | 75 | 65 | 44 | 36 | 70 | 59 | 125 | 105 | 63 | 51 | 57 | 42 | 25 | 16 | 88 | | 57 | 42 | 51 | 38 | 54 | 40 | 167 | | Pittsburgh, Pa. |
| 44 | 185 | | 61 | 46 | 63 | 51 | 67 | 54 | 84 | 79 | 113 | 96 | 58 | 44 | 44 | 31 | 54 | 40 | 83 | | 48 | 34 | 68 | 56 | 54 | 40 | 187 | | Portsmouth, Ohio |
| | | | | | 165 | | 191 | | 191 | | 165 | | 167 | | 191 | | 191 | | 165 | | 191 | | | | | | | | San Francisco, Cal. |
| | | | | | 185 | | 191 | | 191 | | 165 | | 167 | | 191 | | 191 | | 165 | | 191 | | | | | | | | Seattle, Wash. |
| 44 | 187 | | 53 | 38 | 72 | 62 | 52 | 40 | 72 | 62 | 123 | 105 | 58 | 44 | 58 | 38 | 38 | 23 | 86 | | 52 | 37 | 54 | 42 | 48 | 34 | 167 | | Sharon, Pa. |
| 75 | 205 | | 78 | 73 | 86 | 83 | 28 | 19 | 53 | 41 | 134 | 110 | 79 | 75 | 78 | 66 | 48 | 36½ | 100 | | 76 | 68 | 25 | 18½ | 16 | 66 | 184 | | Sparrows Pt., Md. |
| 29 | 148 | | 48 | 34 | 37 | 30½ | 84 | 79 | 90 | 67 | 105 | 88 | 24 | 20 | 48 | 33 | 78 | 66 | 59 | | 44 | 30½ | 85 | 81 | 52 | 37 | 148 | | Sterling, Ill. |
| 34 | 141 | | | | | | 85 | 81 | 94 | 91 | 90 | 70 | 42 | 34 | 44 | 30½ | 77 | 71 | 52 | | 48 | 33 | | | | | 141 | | St. Louis, Mo. |
| | | | | | 165 | | 191 | | 191 | | 167 | | 191 | | 191 | | 191 | | 165 | | 191 | | | | | | | | Torrance, Cal. |
| 79 | 208 | | 79 | 75 | 89 | 66 | 32 | 24 | 42 | 31 | 141 | 118 | 84 | 79 | 79 | 75 | 60 | 39 | 102 | | 79 | 75 | 29 | 19½ | 77 | 71 | 184 | | Trenton, N. J. |
| 51 | 189 | | 58 | 44 | 75 | 65 | 44 | 36 | 70 | 59 | 122 | 105 | 63 | 51 | 57 | 42 | 33 | 20½ | 86 | | 57 | 42 | 51 | 38 | 54 | 40 | 187 | | Weirton, W. Va. |
| 51 | 189 | | 58 | 44 | 75 | 65 | 44 | 36 | 70 | 59 | 122 | 105 | 63 | 51 | 57 | 42 | 33 | 20½ | 86 | | 57 | 42 | 51 | 38 | 54 | 40 | 187 | | Wheeling, W. Va. |
| 84 | 215 | | | | 94 | 91 | 58 | 46 | | | 156 | 126 | 87 | 84 | 86 | 83 | 70 | 59 | 109 | | 86 | 83 | | | | | 184 | | Worcester, Mass. |
| 44 | 187 | | 53 | 36 | 72 | 62 | 52 | 40 | 72 | 62 | 123 | 105 | 66 | 44 | 54 | 40 | 36 | 23 | 66 | | 52 | 37 | 54 | 42 | 48 | 34 | 187 | | Youngstown, Ohio |

**All rates except those marked with asterisk (*) are su**
**to 15 pct increase on total freight charges (Ex Parte 17**
**Federal tax of 3 pct is also added to total freight**

| TO | Louisville, Ky. | | Mansfield, Ohio | | Massillon, Ohio | | Middletown, Ohio | | Midland, Pa. | | Milwaukee, Wis. | | Minnequa, Colo. | | Moline, Ill. | | Morrisville, Pa. | | Muncie, Ind. | | Newark, N. J. | | New Britain, Conn. | | New Castle, Ind. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 |
| Alabama City, Ala. | 55* | 50 | 94 | | 97 | | 89 | | 98 | | 100 | | 141 | | | | 106 | | | | 106 | | | | | |
| Alton, Ill. | 48 | 33 | 63 | 51 | 68 | 56 | 54 | 40 | 75 | 65 | 48 | 38 | 121 | | 34 | 29 | 89 | 86 | 51 | 35 | 91 | 88 | 92 | 89 | 51 | 34½ |
| Ashland, Ky. | 48 | 33 | 42 | 28 | 43 | 29½ | 37 | 25 | 51 | 34½ | 67 | 54 | 143 | | 68 | 56 | 72 | 62 | 43 | 30 | 76 | 68 | 81 | 77 | 43 | 29½ |
| Atlanta, Ga. | 60* | 54 | 97 | | 98 | | 90 | | 99 | | 102 | | 145 | | | | 101 | | | | 101 | | | | | |
| Bethlehem, Pa. | 79 | 75 | 68 | 56 | 62 | 50 | 75 | 65 | 58 | 46 | 84 | 79 | 162 | | 88 | 85 | 23 | 16 | 76 | 68 | 25 | 18 | 43 | 34 | 76 | 68 |
| Birmingham, Ala. | 54* | 49 | 97 | | 98 | | 90 | | 99 | | 97 | | 137 | | | | 114 | | | | 114 | | | | | |
| Buffalo, N. Y. | 70 | 59 | 46 | 32 | 43 | 30 | 58 | 44 | 43 | 30 | 67 | 54 | 149 | | 76 | 68 | 58 | 46 | 61 | 46 | 58 | 46 | 61 | 48 | 61 | 46 |
| Butler, Pa. | 62 | 48 | 40 | 26 | 33 | 20½ | 48 | 34 | 20 | 13 | 68 | 56 | 167 | | 75 | 65 | 57 | 44 | 52 | 37 | 62 | 50 | 68 | 56 | 53 | 38 |
| Canton, Ohio | 57 | 42 | 23 | 14 | 7 | 5½ | 42 | 29 | 25 | 16 | 61 | 46 | 142 | | 67 | 54 | 67 | 54 | 44 | 30½ | 70 | 59 | 75 | 65 | 44 | 31 |
| Chicago, Ill. | 51 | 35 | 51 | 35 | 54 | 40 | 48 | 33 | 62 | 48 | 23 | | 130 | | 33 | 25 | 84 | 79 | 40 | 26 | 86 | 83 | 86 | 83 | 40 | 28 |
| Claymont, Del. | 79 | 75 | 68 | 56 | 63 | 52 | 75 | 65 | 58 | 46 | 86 | 83 | 162 | | 88 | 85 | 15 | 11½ | 76 | 68 | 33 | 22 | 44 | 35 | 77 | 71 |
| Cleveland, Ohio | 54 | 40 | 25 | 16 | 22 | 13½ | 42 | 29 | 33 | 20 | 58 | 44 | 141 | | 67 | 54 | 68 | 56 | 43 | 30 | 70 | 59 | 75 | 62 | 44 | 31 |
| Coatesville, Pa. | 78 | 73 | 67 | 54 | 61 | 48 | 72 | 62 | 54 | 42 | 84 | 79 | 160 | | 87 | 84 | 20 | 14 | 75 | 65 | 34 | 24 | 46 | 38½ | 76 | 68 |
| Conshohocken, Pa. | 79 | 75 | 68 | 56 | 63 | 52 | 75 | 65 | 58 | 46 | 85 | 81 | 162 | | 88 | 85 | 15 | 11 | 77 | 71 | 32 | 21 | 43 | 34 | 77 | 71 |
| Detroit, Mich. | 54 | 40 | 36 | 23 | 40 | 27 | 43 | 29½ | 48 | 33 | 48 | 33 | 138 | | 61 | 46 | 75 | 65 | 43 | 29½ | 75 | 65 | 75 | 65 | 44 | 30½ |
| Dover, Ohio | 54 | 40 | 25 | 16½ | 12 | 7 | 42 | 28 | 25 | 16½ | 62 | 48 | 142 | | 68 | 56 | 67 | 54 | 44 | 30½ | 68 | 56 | 75 | 65 | 44 | 30½ |
| Fairfield, Ala. | 54* | 49 | 97 | | 98 | | 90 | | 99 | | 97 | | 137 | | | | 114 | | | | 114 | | | | | |
| Follansbee, W. Va. | 62 | 48 | 38 | 23 | 25 | 16 | 48 | 34 | 18 | 11 | 68 | 56 | 144 | | 75 | 65 | 57 | 44 | 52 | 37 | 62 | 50 | 70 | 59 | 53 | 38 |
| Gary, Ind. | 51 | 35 | 51 | 35 | 54 | 40 | 48 | 33 | 62 | 48 | 23 | | 130 | | 33 | 25 | 84 | 79 | 34† | 26 | 86 | 83 | 86 | 83 | 34† | 27 |
| Granite City, Ill. | 48 | 33 | 63 | 51 | 53 | 38 | 54 | 40 | 75 | 65 | 48 | 40 | 121 | | 42 | 33 | 89 | 86 | 51 | 35 | 91 | 88 | 92 | 81 | 51 | 34½ |
| Harrisburg, Pa. | 77 | 71 | 61 | 48 | 54 | 40 | 68 | 56 | 51 | 39 | 81 | 77 | 157 | | 85 | 81 | 34 | 24 | 72 | 62 | 40 | 30 | 52 | 40 | 72 | 62 |
| Hartford, Conn. | 68 | 65 | 76 | 68 | 75 | 65 | 81 | 77 | 72 | 62 | 86 | 83 | 166 | | 91 | 88 | 42 | 31 | 84 | 79 | 40 | 29 | 13 | 5½ | 84 | 79 |
| Houston, Tex. | 101 | | 116 | | 120 | | 108 | | 125 | | 111 | | 99 | | | | 141 | | | | 144 | | | | | |
| Ind. Harbor, Ind. | 51 | 35 | 51 | 35 | 57 | 42 | 48 | 33 | 62 | 48 | 23 | | 130 | | 33 | 25 | 84 | 79 | 40 | 26 | 86 | 83 | 86 | 83 | 40 | 27 |
| Johnstown, Pa. | 68 | 56 | 44 | 31 | 40 | 27 | 54 | 40 | 34 | 21 | 72 | 62 | 150 | | 77 | 71 | 51 | 39 | 58 | 44 | 52 | 40 | 63 | 52 | 58 | 44 |
| Kokomo, Ind. | 37 | 25 | 42 | 29 | 48 | 33 | 34 | 22 | 54 | 40 | 43 | 29½ | 132 | | 48 | 33 | 79 | 75 | 18 | 11 | 84 | 79 | 85 | 81 | 20 | 13 |
| Los Angeles, Cal. | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 165 | | | | 191 | | | | 191 | | | | | |
| Mansfield, Ohio | 51 | 35 | | | 23 | 14 | 36 | 23 | 36 | 23 | 57 | 42 | 138 | | 62 | 48 | 70 | 59 | 37 | 25 | 75 | 65 | 76 | 68 | 40 | 26 |
| Massillon, Ohio | 57 | 42 | 23 | 14 | | | 42 | 29 | 51 | 34½ | 61 | 46 | 142 | | 67 | 54 | 67 | 54 | 44 | 30½ | 70 | 59 | 75 | 65 | 44 | 31 |
| Middletown, Ohio | 37 | 25 | 36 | 22 | 42 | 29 | | | 48 | 34 | 54 | 40 | 136 | | 61 | 46 | 76 | 68 | 29 | 18 | 78 | 73 | 81 | 77 | 25 | 16½ |
| Midland, Pa. | 62 | 48 | 34 | 22 | 24 | 15 | 48 | 34 | | | 68 | 56 | 146 | | 75 | 65 | 57 | 44 | 52 | 37 | 62 | 52 | 70 | 59 | 53 | 38 |
| Minnequa, Colo. | 134 | | 138 | | 142 | | 136 | | 146 | | 132 | | | | | | 164 | | | | 165 | | | | | |
| Morrisville, Pa. | 81 | 77 | 70 | 59 | 67 | 54 | 76 | 68 | 61 | 48 | 86 | 83 | 164 | | | | | | | | 18 | 12 | | | | |
| Newark, N. J. | 85 | 81 | 75 | 65 | 70 | 59 | 78 | 73 | 67 | 54 | 86 | 83 | 165 | | | | 18 | 12 | | | | | | | | |
| New Haven, Conn. | 88 | 85 | 77 | 71 | 76 | 68 | 84 | 79 | 72 | 62 | 87 | 84 | 166 | | 92 | 89 | 40 | 29 | 84 | 79 | 33 | 23 | 19 | 9 | 85 | 81 |
| Niles, Cal. | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 165 | | | | 191 | | | | 191 | | | | | |
| Niles, Ohio | 61 | 46 | 33 | 20 | 19 | 12 | 46 | 32 | 18 | 11 | 63 | 51 | 144 | | 70 | 59 | 62 | 50 | 51 | 34½ | 67 | 54 | 72 | 62 | 51 | 34½ |
| Phoenixville, Pa. | 79 | 75 | 68 | 56 | 62 | 50 | 75 | 65 | 57 | 44 | 85 | 81 | 162 | | 87 | 84 | 15 | 11½ | 76 | 68 | 33 | 22 | 44 | 35 | 76 | 68 |
| Pittsburg, Cal. | 191 | | 191 | | 191 | | 191 | | 191 | | 191 | | 165 | | | | 191 | | | | 191 | | | | | |
| Pittsburgh, Pa. | 62 | 48 | 40 | 26 | 33 | 20 | 48 | 34 | 15 | 9 | 68 | 56 | 146 | | 75 | 65 | 57 | 44 | 52 | 37 | 62 | 50 | 70 | 59 | 53 | 38 |
| Portsmouth, Ohio | 48 | 33 | 42 | 28 | 43 | 29½ | 37 | 25 | 51 | 34½ | 67 | 54 | 141 | | 68 | 56 | 72 | 62 | 58 | 30 | 76 | 68 | 81 | 77 | 43 | 29½ |
| San Francisco, Cal. | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 165 | | | | 191 | | | | 191 | | | | | |
| Seattle, Wash. | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 165 | | | | 191 | | | | 191 | | | | | |
| Sharon, Pa. | 61 | 46 | 34 | 22 | 25 | 16 | 46 | 32 | 22 | 13½ | 63 | 51 | 144 | | 70 | 59 | 62 | 50 | 51 | 34½ | 67 | 54 | 72 | 62 | 51 | 35 |
| Sparrows Pt., Md. | 77 | 71 | 67 | 54 | 61 | 48 | 70 | 69 | 54 | 42 | 84 | 79 | 160 | | 87 | 84 | 34 | 24 | 75 | 65 | 42 | 31 | 53 | 41 | 75 | 65 |
| Sterling, Ill. | 57 | 42 | 61 | 46 | 63 | 51 | 57 | 42 | 70 | 59 | 24 | | 125 | | 19 | 12 | 88 | 85 | 51 | 34½ | 89 | 86 | 90 | 87 | 51 | 35 |
| St. Louis, Mo. | 48 | 33 | 63 | 51 | 68 | 56 | 54 | 40 | 75 | 65 | 48 | 40 | 121 | | | | 89 | 88 | | | 91 | 88 | | | | |
| Torrance, Cal. | 191 | | 191 | | 191 | | 191 | | 191 | | 167 | | 165 | | | | 191 | | | | 191 | | | | | |
| Trenton, N. J. | 81 | 77 | 70 | 59 | 67 | 54 | 76 | 68 | 61 | 48 | 86 | 83 | 164 | | 89 | 86 | 6 | 5 | 77 | 71 | 18 | 12 | 42 | 31 | 77 | 71 |
| Weirton, W. Va. | 62 | 48 | 34 | 22 | 25 | 16 | 48 | 34 | 18 | 11 | 68 | 56 | 144 | | 75 | 65 | 57 | 44 | 52 | 37 | 62 | 50 | 70 | 59 | 53 | 38 |
| Wheeling, W. Va. | 62 | 48 | 36 | 23 | 25 | 16 | 48 | 34 | 23 | 14 | 68 | 56 | 144 | | 75 | 65 | 57 | 44 | 52 | 37 | 62 | 50 | 70 | 59 | 53 | 38 |
| Worcester, Mass. | 89 | 86 | 77 | 71 | 76 | 68 | 84 | 79 | 76 | 68 | 87 | 84 | 169 | | | | 48 | 37 | | | 44 | 36 | | | | |
| Youngstown, Ohio | 61 | 46 | 33 | 20 | 22 | 13½ | 46 | 32 | 20 | 13 | 63 | 51 | 144 | | 70 | 59 | 62 | 50 | 51 | 34½ | 67 | 54 | 72 | 62 | 51 | 35 |

* Shipments to points marked with asterisk (*) are not subject to 15 pct increase under Ex Parte 175-B.

† Minimum carload weight 36,000 lb.

Figures (40) and (80) at top of columns denote 40,000 and 80,000-lb minimum carload weights.

(*) are subject
x Parte 175-B).
al freight bill.

# IRON & STE
# FREIGHT RA

| New Castle, Ind. | | New Castle, Pa. | | New Haven, Conn. | | New York, N. Y. | | Niles, Cal. | | Niles, Ohio | | Peoria, Ill. | | Philadelphia, Pa. | | Phoenixville, Pa. | | Pittsburg, Cal. | | Pittsburgh, Pa. | | Portsmouth, Ohio | | Reading, Pa. | | Rochester, N. Y. | | Rockford, Ill. | | San Francisco, Cal. | | Seattle, Wash. | | Sharon, Pa. | | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | |
| | | | | | 110 | | 106 | | 158 | | 98 | | | | | | 106 | | 158 | | 98 | | 64* | 58 | | | | | | | 158 | | 158 | | 98 | | 9 |
| 89 | 51 | 34½ | 72 | 62 | 94 | 91 | 91 | 88 | 141 | | 72 | 62 | 32 | 22 | 88 | 85 | 87 | 84 | 141 | | 75 | 65 | 62 | 48 | 87 | 84 | 79 | 75 | 42 | 32 | 141 | | 141 | | 72 | 62 | 5 |
| 77 | 43 | 29½ | 52 | 37 | 81 | 77 | 76 | 68 | 167 | | 48 | 34 | 62 | 48 | 72 | 62 | 70 | 59 | 167 | | 51 | 34½ | 18 | 11 | 68 | 56 | 68 | 56 | 67 | 54 | 167 | | 167 | | 51 | 35 | 5 |
| | | | | | 105 | | 101 | | 167 | | 99 | | | | | | 101 | | 167 | | 99 | | 66* | 59 | | | | | | | 167 | | 167 | | 99 | | 9 |
| 34 | 76 | 68 | 58 | 46 | 42 | 31 | 29 | 19½ | 184 | | 61 | 48 | 86 | 83 | 20 | 14 | 18 | 12 | 184 | | 54 | 42 | 70 | 59 | 15 | 11 | 51 | 39 | 86 | 83 | 184 | | 184 | | 58 | 46 | 7 |
| | | | | | 112 | | 114 | | 158 | | 99 | | | | | | 114 | | 158 | | 99 | | 70* | 63 | | | | | | | 154 | | 158 | | 99 | | 9 |
| 48 | 61 | 46 | 40 | 27 | 61 | 48 | 58 | 46 | 167 | | 40 | 26 | 75 | 65 | 58 | 46 | 57 | 44 | 167 | | 44 | 30½ | 61 | 46 | 54 | 42 | 23 | 16 | 72 | 82 | 167 | | 167 | | 37 | 25 | 6 |
| 56 | 53 | 38 | 15 | 9 | 68 | 56 | 62 | 50 | 167 | | 23 | 14 | 70 | 59 | 54 | 40 | 53 | 41 | 167 | | 15 | 10 | 48 | 34 | 52 | 37 | 51 | 34½ | 70 | 59 | 167 | | 167 | | 20 | 13 | 5 |
| 65 | 44 | 31 | 25 | 16 | 72 | 62 | 70 | 59 | 167 | | 19 | 12 | 62 | 48 | 63 | 52 | 62 | 50 | 167 | | 32 | 19 | 43 | 29½ | 61 | 48 | 51 | 38 | 62 | 48 | 167 | | 167 | | 24 | 15 | 4 |
| 83 | 40 | 28 | 61 | 46 | 87 | 84 | 86 | 83 | 148 | | 58 | 44 | 32 | 23 | 84 | 79 | 81 | 77 | 148 | | 63 | 51 | 57 | 42 | 79 | 75 | 72 | 62 | 23 | 16½ | 148 | | 148 | | 61 | 46 | 3 |
| 35 | 77 | 71 | 58 | 46 | 42 | 32 | 33 | 22 | 184 | | 61 | 48 | 87 | 84 | 9 | 6½ | 14 | 10 | 184 | | 54 | 42 | 70 | 59 | 23 | 16 | 57 | 44 | 86 | 83 | 184 | | 184 | | 61 | 48 | 7 |
| 62 | 44 | 31 | 28 | 17 | 72 | 62 | 70 | 59 | 167 | | 20 | 13 | 62 | 48 | 67 | 54 | 63 | 52 | 167 | | 34 | 22 | 44 | 30½ | 62 | 50 | 44 | 36 | 61 | 48 | 167 | | 167 | | 25 | 16 | 4 |
| 36½ | 78 | 68 | 54 | 42 | 43 | 34 | 34 | 24 | 184 | | 58 | 46 | 86 | 83 | 15 | 11½ | 12 | 8½ | 184 | | 52 | 40 | 68 | 56 | 15 | 11½ | 53 | 41 | 85 | 81 | 184 | | 184 | | 57 | 44 | 7 |
| 34 | 77 | 71 | 58 | 46 | 42 | 31 | 32 | 21 | 184 | | 61 | 48 | 86 | 83 | 9 | 6½ | 9 | 6½ | 184 | | 54 | 42 | 70 | 59 | 15 | 11½ | 53 | 41 | 86 | 83 | 184 | | 184 | | 61 | 48 | 7 |
| 65 | 44 | 30½ | 32 | 18½ | 76 | 68 | 75 | 65 | 158 | | 43 | 30 | 58 | 44 | 75 | 65 | 75 | 65 | 158 | | 51 | 35 | 48 | 34 | 72 | 62 | 51 | 39 | 54 | 40 | 158 | | 158 | | 44 | 31 | 4 |
| | | | | | 72 | 62 | 68 | 56 | 167 | | 23 | 14 | 63 | 51 | 63 | 51 | 62 | 50 | 167 | | 32 | 18½ | 42 | 28 | 58 | 44 | 52 | 37 | 62 | 48 | 167 | | 167 | | 29 | 18½ | 5 |
| 65 | 44 | 30½ | 32 | 18½ | 112 | | 114 | | 158 | | 99 | | | | | | 114 | | 158 | | 99 | | 70* | 63 | | | | | | | 158 | | 158 | | 99 | | 9 |
| 59 | 53 | 38 | 24 | 15 | 68 | 56 | 62 | 50 | 167 | | 29 | 18 | 70 | 59 | 54 | 42 | 53 | 41 | 167 | | 18 | 11 | 48 | 34 | 52 | 40 | 51 | 39 | 70 | 59 | 167 | | 167 | | 29 | 18 | 5 |
| 83 | 34† | 27 | 61 | 46 | 87 | 84 | 86 | 83 | 148 | | 58 | 44 | 32 | 23 | 84 | 79 | 81 | 77 | 148 | | 63 | 51 | 57 | 42 | 79 | 75 | 72 | 62 | 23 | 16½ | 148 | | 148 | | 61 | 46 | 3 |
| 81 | 51 | 34½ | 72 | 62 | 94 | 91 | 91 | 88 | 141 | | 72 | 62 | 32 | 24 | 88 | 85 | 87 | 84 | 141 | | 75 | 65 | 62 | 48 | 87 | 84 | 79 | 75 | 42 | 34 | 148 | | 141 | | 72 | 62 | 5 |
| 40 | 72 | 62 | 51 | 39 | 51 | 38 | 40 | 30 | 184 | | 53 | 41 | 81 | 77 | 33 | 22 | 25 | 18½ | 184 | | 44 | 36 | 63 | 52 | 19 | 13 | 48 | 37 | 81 | 77 | 184 | | 184 | | 52 | 40 | 7 |
| 5½ | 84 | 79 | 72 | 62 | | | | | 184 | | 72 | 62 | 90 | 87 | 44 | 35 | 44 | 36 | 184 | | 70 | 59 | 81 | 77 | 48 | 37 | 53 | 41 | 89 | 86 | 184 | | 184 | | 70 | 59 | 5 |
| | | | | | 150 | | 144 | | 135 | | 123 | | | | | | 140 | | 135 | | 125 | | 113 | | | | | | | | 135 | | 147 | | 123 | | 11 |
| 83 | 40 | 27 | 61 | 46 | 87 | 84 | 86 | 83 | 148 | | 58 | 44 | 32 | 23 | 84 | 79 | 81 | 77 | 148 | | 63 | 51 | 57 | 42 | 79 | 75 | 72 | 62 | 23 | 16½ | 148 | | 148 | | 61 | 46 | 3 |
| 52 | 58 | 44 | 34 | 21 | 63 | 52 | 54 | 42 | 184 | | 36 | 24 | 75 | 65 | 48 | 37½ | 46 | 36½ | 184 | | 25 | 16 | 54 | 40 | 43 | 34 | 51 | 38 | 75 | 65 | 184 | | 184 | | 36 | 23 | 6 |
| 81 | 20 | 13 | 53 | 38 | 85 | 81 | 84 | 79 | 158 | | 52 | 37 | 42 | 28 | 78 | 73 | 77 | 71 | 158 | | 57 | 42 | 44 | 31 | 77 | 71 | 68 | 56 | 43 | 29½ | 158 | | 158 | | 53 | 38 | 2 |
| | | | | | 191 | | 191 | | | | 191 | | | | | | 191 | | | | 191 | | 191 | | | | | | | | | | | | 191 | | 19 |
| 68 | 40 | 26 | 34 | 22 | 77 | 71 | 75 | 65 | 167 | | 33 | 20 | 58 | 44 | 68 | 56 | 68 | 56 | 167 | | 40 | 26 | 40 | 26 | 63 | 52 | 53 | 41 | 57 | 42 | 167 | | 167 | | 34 | 22 | 4 |
| 65 | 44 | 31 | 25 | 16 | 72 | 62 | 70 | 59 | 167 | | 19 | 12 | 62 | 48 | 63 | 51 | 62 | 50 | 167 | | 32 | 19 | 43 | 29½ | 61 | 46 | 51 | 41½ | 62 | 48 | 167 | | 167 | | 24 | 15 | 4 |
| 77 | 25 | 16½ | 48 | 34 | 84 | 79 | 78 | 73 | 158 | | 44 | 31 | 52 | 37 | 75 | 65 | 75 | 65 | 158 | | 48 | 34 | 34 | 22 | 72 | 62 | 62 | 50 | 54 | 40 | 158 | | 158 | | 48 | 34 | 4 |
| 59 | 53 | 38 | 14 | 8 | 68 | 56 | 62 | 50 | 167 | | 20 | 13 | 70 | 59 | 54 | 42 | 53 | 41 | 167 | | 15 | 9 | 48 | 34 | 52 | 40 | 51 | 39 | 70 | 59 | 167 | | 167 | | 19 | 12 | 5 |
| | | | | | 166 | | 165 | | 120 | | 144 | | | | | | 162 | | 120 | | 146 | | 141 | | | | | | | | 120 | | 120 | | 144 | | 13 |
| | | | | | 37 | 28 | 25 | 18 | 184 | | 62 | 50 | | | | | 15 | 11½ | 184 | | 57 | 44 | 72 | 62 | | | | | | | 184 | | 184 | | 82 | 50 | 7 |
| | | | | | 33 | 23 | 15 | 11 | 184 | | 68 | 56 | | | | | 33 | 22 | 184 | | 62 | 50 | 76 | 68 | | | | | | | 184 | | 184 | | 67 | 54 | 8 |
| 9 | 85 | 81 | 72 | 62 | | | | | 184 | | 72 | 62 | 90 | 87 | 42 | 31 | 42 | 32 | 184 | | 68 | 58 | 81 | 77 | 44 | 35 | 54 | 42 | 89 | 86 | 184 | | 184 | | 72 | 62 | 8 |
| | | | | | 191 | | 191 | | | | 191 | | | | | | 191 | | | | 191 | | 191 | | | | | | | | | | | | 191 | | 19 |
| 62 | 51 | 34½ | 12 | 7½ | 72 | 62 | 67 | 54 | 167 | | | | 67 | 54 | 61 | 46 | 58 | 46 | 167 | | 24 | 15 | 48 | 34 | 57 | 42 | 40 | 30½ | 67 | 54 | 167 | | 167 | | 12 | 7 | 5 |
| 35 | 76 | 68 | 56 | 44 | 42 | 32 | 33 | 22 | 184 | | 61 | 48 | 86 | 83 | 12 | 9 | 33 | 22 | 184 | | 53 | 41 | 70 | 59 | 14 | 10 | 53 | 41 | 86 | 83 | 184 | | 184 | | 54 | 46 | 7 |
| | | | | | 191 | | 191 | | | | 191 | | | | | | 191 | | | | 191 | | 191 | | | | | | | | | | | | 191 | | 19 |
| 59 | 53 | 38 | 18 | 11 | 68 | 56 | 62 | 50 | 167 | | 24 | 15 | 70 | 59 | 54 | 42 | 53 | 41 | 167 | | | | 48 | 34 | 52 | 40 | 51 | 39 | 72 | 59 | 167 | | 167 | | 23 | 14 | 5 |
| 77 | 43 | 29½ | 52 | 37 | 81 | 77 | 76 | 68 | 167 | | 48 | 34 | 62 | 48 | 72 | 62 | 86 | 83 | 167 | | 51 | 34½ | | | 68 | 56 | 68 | 53 | 67 | 54 | 167 | | 167 | | 51 | 35 | 5 |
| | | | | | 191 | | 191 | | | | 191 | | | | | | 191 | | | | 191 | | 191 | | | | | | | | | | | | 191 | | 19 |
| | | | | | 191 | | 191 | | | | 191 | | | | | | 191 | | | | 191 | | 191 | | | | | | | | | | | | 191 | | 19 |
| 62 | 51 | 35 | 12 | 7 | 72 | 62 | 67 | 54 | 167 | | 12 | 7 | 67 | 54 | 61 | 48 | 58 | 46 | 167 | | 23 | 14 | 48 | 34 | 57 | 44 | 44 | 35 | 67 | 54 | 167 | | 167 | | | | 5 |
| 41 | 75 | 65 | 54 | 42 | 51 | 39 | 42 | 31 | 184 | | 58 | 46 | 85 | 81 | 29 | 19½ | 33 | 23 | 184 | | 52 | 40 | 67 | 54 | 33 | 23 | 54 | 42 | 85 | 81 | 184 | | 184 | | 57 | 44 | 7 |
| 87 | 51 | 35 | 68 | 56 | 90 | 87 | 89 | 86 | 148 | | 67 | 54 | 23 | 18 | 87 | 84 | 86 | 83 | 148 | | 70 | 59 | 67 | 54 | 85 | 81 | 76 | 68 | 19 | 13½ | 148 | | 148 | | 68 | 56 | 4 |
| | | | | | 94 | 91 | 91 | 88 | 141 | | 72 | 62 | | | | | 87 | 84 | 141 | | 76 | 65 | 62 | 48 | | | | | | | 141 | | 141 | | 72 | 62 | 5 |
| | | | | | 191 | | 191 | | | | 191 | | | | | | 191 | | | | 191 | | 191 | | | | | | | | | | | | 191 | | 19 |
| 31 | 77 | 71 | 61 | 48 | 37 | 28 | 24 | 17 | 184 | | 62 | 50 | 87 | 84 | 14 | 10 | 15 | 11½ | 184 | | 57 | 44 | 72 | 62 | 24 | 17 | 53 | 41 | 87 | 84 | 184 | | 184 | | 62 | 50 | 7 |
| 59 | 53 | 38 | 23 | 14 | 68 | 56 | 62 | 50 | 167 | | 28 | 17 | 70 | 59 | 54 | 42 | 53 | 41 | 167 | | 15 | 10 | 48 | 34 | 52 | 40 | 51 | 39 | 70 | 59 | 167 | | 167 | | 28 | 17 | 5 |
| 59 | 53 | 38 | 29 | 18 | 68 | 56 | 62 | 50 | 167 | | 32 | 19 | 70 | 59 | 54 | 42 | 53 | 41 | 167 | | 20 | 13 | 48 | 34 | 52 | 40 | 51 | 39 | 70 | 59 | 167 | | 167 | | 33 | 20½ | 5 |
| | | | | | | | | | 184 | | 75 | 65 | | | | | | | 184 | | 75 | 65 | 85 | 81 | | | | | | | 184 | | 184 | | 72 | 82 | 8 |
| 62 | 51 | 35 | 12 | 7 | 72 | 62 | 67 | 54 | 167 | | 7 | 5½ | 67 | 54 | 61 | 48 | 52 | 41 | 167 | | 22 | 13½ | 48 | 34 | 57 | 44 | 44 | 35 | 67 | 54 | 167 | | 167 | | 9 | 6 | 5 |

# EEL TES

## Carload rates in cents per 100 lb

| uth Bend, Ind. | | Sparrows Pt., Md. | | Springfield, Ill. | | Springfield, Mass. | | Sterling, Ill. | | St. Louis, Mo. | | Syracuse, N. Y. | | Toledo, Ohio | | Torrance, Cal. | | Tranton, N. J. | | Utica, N. Y. | | Weirton, W. Va. | | Wheeling, W. Va. | | Worcester, Mass. | | York, Pa. | | Youngs-town, Ohio | | TO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | 40 | 80 | FROM |
| 2 | | 101 | | | | | | [illegible] | | 70* | 63 | | | 95 | | 158 | | 106 | | | | 98 | | 98 | | 110 | | | | 98 | | Alabama City, Ala. |
| 3 | 38 | 86 | 83 | 29 | 15 | 92 | 89 | 37 | 29½ | | | 85 | 81 | 62 | 48 | 141 | | 89 | 86 | 88 | 83 | 72 | 62 | 70 | 59 | 94 | 91 | 86 | 83 | 72 | 62 | Alton, Ill. |
| 4 | 40 | 67 | 54 | 62 | 48 | 84 | 79 | 68 | 56 | 63 | 51 | 72 | 62 | 44 | 31 | 167 | | 86 | 83 | 75 | 65 | 46 | 32 | 43 | 30 | 67 | 54 | 67 | 54 | 51 | 34½ | Ashland, Ky. |
| 8 | | 97 | | | | | | 100 | | 77* | 69 | | | 97 | | 167 | | 101 | | | | 99 | | 99 | | 105 | | | | 99 | | Atlanta, Ga. |
| 9 | 73 | 36 | 27 | 88 | 83 | 46 | 36½ | 87 | 84 | 88 | 85 | 44 | 35 | 72 | 62 | 184 | | 22 | 15 | 44 | 36 | 58 | 46 | 58 | 46 | 51 | 39 | 32 | 20 | 61 | 48 | Bethlehem, Pa. |
| 1 | | 103 | | | | | | [illegible] | | 62* | 56 | | | 97 | | 158 | | 114 | | | | 99 | | 99 | | 112 | | | | 99 | | Birmingham, Ala. |
| 1 | 46 | 58 | 46 | 75 | 65 | 48 | 46 | 75 | 65 | 77 | 71 | 36 | 26 | 51 | 31½ | 167 | | 58 | 46 | 42 | 32 | 46 | 32 | 48 | 34 | 62 | 50 | 53 | 41 | 40 | 26 | Buffalo, N. Y. |
| 7 | 42 | 52 | 40 | 70 | 59 | 72 | 62 | 70 | 59 | 75 | 65 | 57 | 42 | 41 | 30½ | 167 | | 57 | 44 | 61 | 46 | 25 | 16½ | 33 | 20 | 75 | 65 | 48 | 33 | 20 | 13 | Butler, Pa. |
| 8 | 33 | 61 | 48 | 63 | 51 | 75 | 65 | 63 | 51 | 68 | 56 | 50 | 34 | 34 | 22 | 167 | | 67 | 54 | 61 | 48 | 25 | 15 | 25 | 16½ | 76 | 68 | 57 | 44 | 20 | 13 | Canton, Ohio |
| 8 | 17 | 79 | 75 | 34 | 25 | 86 | 83 | 24 | 20 | 42 | 34 | 76 | 68 | 44 | 30½ | 148 | | 84 | 79 | 77 | 71 | 61 | 46 | 62 | 48 | 87 | 84 | 78 | 73 | 58 | 44 | Chicago, Ill. |
| 8 | 73 | 25 | 18 | 87 | 84 | 48 | 37½ | 87 | 84 | 88 | 85 | 52 | 40 | 72 | 62 | 184 | | 15 | 11½ | 52 | 40 | 58 | 46 | 61 | 48 | 52 | 40 | 29 | 19½ | 61 | 48 | Claymont, Del. |
| 6 | 32 | 62 | 50 | 63 | 51 | 72 | 62 | 62 | 48 | 68 | 56 | 53 | 41 | 33 | 20 | 167 | | 68 | 56 | 57 | 44 | 33 | 20½ | 34 | 22 | 75 | 65 | 61 | 48 | 23 | 14 | Cleveland, Ohio |
| 7 | 71 | 28 | 19 | 86 | 83 | 51 | 38 | 86 | 83 | 87 | 84 | 51 | 39 | 70 | 59 | 184 | | 20 | 14 | 52 | 40 | 54 | 40 | 57 | 44 | 53 | 41 | 20 | 14 | 57 | 44 | Coatesville, Pa. |
| 8 | 73 | 33 | 22 | 87 | 84 | 48 | 37 | 87 | 84 | 88 | 85 | 51 | 38 | 72 | 62 | 184 | | 15 | 11 | 51 | 39 | 58 | 46 | 61 | 48 | 52 | 40 | 20 | 19½ | 61 | 48 | Conshohocken, Pa. |
| 0 | 27 | 68 | 56 | 61 | 46 | 75 | 65 | 57 | 42 | 63 | 51 | 57 | 44 | 20 | 13 | 158 | | 75 | 65 | 62 | 50 | 46 | 32 | 48 | 33 | 77 | 71 | 72 | 62 | 43 | 30 | Detroit, Mich. |
| 1 | 34½ | 68 | 56 | 73 | 51 | 75 | 65 | 63 | 51 | 68 | 56 | 58 | 44 | 36 | 23 | 167 | | 67 | 54 | 62 | 48 | 22 | 13 | 23 | 14 | 77 | 71 | 57 | 42 | 25 | 16 | Dover, Ohio |
| 6 | | 103 | | | | | | 96 | | 62* | 58 | | | 97 | | 158 | | 114 | | | | 99 | | 99 | | 112 | | | | 99 | | Fairfield, Ala. |
| 7 | 42 | 52 | 40 | 70 | 59 | 72 | 62 | 70 | 59 | 75 | 65 | 57 | 44 | 44 | 30½ | 167 | | 57 | 44 | 61 | 48 | 7 | 5½ | 10 | 6½ | 75 | 65 | 48 | 37 | 28 | 17 | Follansbee, W. Va. |
| 8 | 17 | 79 | 75 | 34 | 25 | 86 | 83 | 24 | 20 | 42 | 34 | 76 | 68 | 44 | 30½ | 148 | | 84 | 79 | 77 | 71 | 61 | 46 | 62 | 48 | 87 | 84 | 78 | 73 | 58 | 44 | Gary, Ind. |
| 9 | 38 | 86 | 83 | 29 | 18 | 92 | 89 | 37 | 30½ | | | 85 | 81 | 62 | 48 | 141 | | 89 | 86 | 86 | 83 | 72 | 62 | 70 | 59 | 94 | 91 | 86 | 63 | 72 | 62 | Granite City, Ill. |
| 5 | 65 | 28 | 19 | 84 | 79 | 54 | 42 | 84 | 79 | 85 | 81 | 48 | 37 | 67 | 54 | 184 | | 34 | 24 | 51 | 38 | 51 | 38 | 52 | 40 | 58 | 46 | 12 | 9 | 52 | 40 | Harrisburg, Pa. |
| 4 | 91 | 53 | 41 | 91 | 88 | 19 | 9 | 90 | 87 | 94 | 91 | 48 | 36½ | 77 | 71 | 184 | | 44 | 35 | 43 | 33 | 75 | 65 | 75 | 65 | | | 52 | 41 | 72 | 62 | Hartford, Conn. |
| 0 | | 134 | | | | | | 105 | | 90 | | | | 114 | | 135 | | 141 | | | | 122 | | 122 | | 156 | | | | 123 | | Houston, Tex. |
| 8 | 17 | 79 | 75 | 34 | 25 | 86 | 83 | 24 | 20 | 42 | 34 | 78 | 68 | 44 | 30½ | 148 | | 84 | 79 | 77 | 71 | 61 | 46 | 62 | 48 | 87 | 84 | 78 | 73 | 58 | 44 | Ind. Harbor, Ind. |
| 5 | 51 | 46 | 36½ | 75 | 65 | 67 | 54 | 76 | 68 | 77 | 71 | 52 | 40 | 52 | 37 | 184 | | 51 | 39 | 54 | 42 | 33 | 20½ | 34 | 22 | 70 | 59 | 42 | 31 | 36 | 23 | Johnstown, Pa. |
| 3 | 17 | 76 | 68 | 42 | 29 | 84 | 79 | 44 | 30½ | 48 | 33 | 72 | 62 | 40 | 26 | 158 | | 48 | 33 | 75 | 65 | 53 | 38 | 53 | 38 | 86 | 83 | 76 | 68 | 52 | 37 | Kokomo, Ind. |
| | | 191 | | | | | | 167 | | 165 | | | | 191 | | | | | | | | 191 | | 191 | | 191 | | | | 191 | | Los Angeles, Cal. |
| 3 | 29½ | 67 | 54 | 61 | 46 | 76 | 68 | 61 | 46 | 63 | 51 | 61 | 48 | 25 | 16½ | 167 | | 70 | 59 | 63 | 52 | 34 | 22 | 36 | 23 | 77 | 71 | 62 | 50 | 33 | 20½ | Mansfield, Ohio |
| 3 | 33 | 61 | 48 | 63 | 51 | 75 | 65 | 63 | 51 | 68 | 56 | 57 | 42 | 34 | 22 | 167 | | 67 | 54 | 61 | 46 | 24 | 15 | 25 | 16½ | 76 | 68 | 57 | 42 | 20 | 13 | Massillon, Ohio |
| 3 | 30 | 70 | 59 | 52 | 37 | 81 | 77 | 57 | 42 | 54 | 40 | 68 | 56 | 37 | 25 | 158 | | 76 | 68 | 72 | 62 | 44 | 31 | 44 | 30½ | 84 | 79 | 70 | 59 | 46 | 32 | Middletown, Ohio |
| | 42 | 52 | 40 | 70 | 59 | 72 | 62 | 70 | 59 | 75 | 65 | 57 | 44 | 44 | 30½ | 167 | | 57 | 44 | 61 | 48 | 15 | 9 | 20 | 13 | 75 | 65 | 48 | 37½ | 18 | 11 | Midland, Pa. |
| | | 160 | | | | | | 125 | | 121 | | | | 137 | | 120 | | 164 | | | | 144 | | 144 | | 169 | | | | 144 | | Minnequa, Colo. |
| | 75 | 34 | 24 | | | | | 88 | 85 | 89 | 86 | | | 75 | 65 | 184 | | 6 | 5 | | | 61 | 48 | 62 | 48 | 48 | 37 | | | 62 | 48 | Morrisville, Pa. |
| | 79 | 42 | 31 | | | | | 89 | 86 | 91 | 88 | | | 77 | 71 | 184 | | 18 | 12 | | | 67 | 54 | 67 | 54 | 44 | 36 | | | 67 | 54 | Newark, N. J. |
| | 81 | 51 | 39 | 91 | 88 | 25 | 15 | 90 | 87 | 94 | 91 | 48 | 37½ | 78 | 73 | 184 | | 37 | 28 | 43 | 34 | 72 | 62 | 72 | 62 | | | 51 | 38 | 72 | 62 | New Haven, Conn. |
| | | 191 | | | | | | 167 | | 165 | | | | 191 | | | | 191 | | | | 191 | | 191 | | 191 | | | | 191 | | Niles, Cal. |
| | 37 | 57 | 44 | 53 | 38 | 70 | 59 | 68 | 56 | 53 | 38 | 52 | 37 | 40 | 26 | 167 | | 62 | 50 | 57 | 42 | 28 | 17 | 32 | 19 | 75 | 65 | 53 | 38 | 7 | 5½ | Niles, Ohio |
| | 73 | 33 | 23 | 86 | 83 | 48 | 37 | 86 | 83 | 87 | 84 | 48 | 37½ | 72 | 62 | 184 | | 15 | 11½ | 51 | 38 | 57 | 44 | 58 | 46 | 52 | 40 | 25 | 18½ | 58 | 46 | Phoenixville, Pa. |
| | | 191 | | | | | | 167 | | 165 | | | | 191 | | | | 191 | | | | 191 | | 191 | | 191 | | | | 191 | | Pittsburg, Cal. |
| | 42 | 52 | 40 | 70 | 59 | 72 | 62 | 70 | 59 | 75 | 65 | 57 | 44 | 44 | 30½ | 167 | | 57 | 44 | 61 | 48 | 15 | 10 | 20 | 13 | 75 | 65 | 48 | 37½ | 23 | 13 | Pittsburgh, Pa. |
| | 40 | 67 | 54 | 62 | 48 | 84 | 79 | 68 | 56 | 63 | 51 | 72 | 62 | 44 | 31 | 167 | | 72 | 62 | 75 | 65 | 46 | 32 | 43 | 30 | 86 | 83 | 67 | 54 | 51 | 34½ | Portsmouth, Ohio |
| | | 191 | | | | | | 167 | | 165 | | | | 191 | | | | 191 | | | | 191 | | 191 | | 191 | | | | 191 | | San Francisco, Cal. |
| | | 191 | | | | | | 167 | | 165 | | | | 191 | | | | 191 | | | | 191 | | 191 | | 191 | | | | 191 | | Seattle, Wash. |
| | 37 | 57 | 44 | 68 | 56 | 70 | 59 | 68 | 56 | 53 | 38 | 52 | 40 | 40 | 26 | 167 | | 62 | 50 | 57 | 34 | 28 | 17 | 33 | 20½ | 75 | 65 | 53 | 41 | 9 | 6 | Sharon, Pa. |
| | 71 | | | 84 | 79 | 54 | 42 | 86 | 83 | 86 | 83 | 54 | 42 | 68 | 56 | 184 | | 34 | 24 | 57 | 44 | 54 | 40 | 54 | 40 | 58 | 46 | 20 | 14 | 57 | 44 | Sparrows Pt., Md. |
| | 28 | 86 | 83 | 34 | 23 | 89 | 86 | | | 37 | 30½ | 79 | 75 | 53 | 38 | 148 | | 88 | 85 | 84 | 79 | 68 | 56 | 70 | 59 | 91 | 88 | 85 | 81 | 68 | 56 | Sterling, Ill. |
| | 38 | 86 | 83 | | | | | 37 | 30½ | | | | | 62 | 48 | 141 | | 89 | 86 | | | 72 | 62 | 70 | 59 | 94 | 91 | | | 72 | 62 | St. Louis, Mo. |
| | | 191 | | | | | | 167 | | 165 | | | | 191 | | | | 191 | | | | 191 | | 191 | | 191 | | | | 191 | | Torrance, Cal. |
| | 75 | 34 | 24 | 87 | 84 | 43 | 33 | 88 | 85 | 89 | 86 | 48 | 37½ | 75 | 65 | 184 | | | | 51 | 38 | 61 | 48 | 62 | 50 | 48 | 37 | 33 | 23 | 62 | 50 | Trenton, N. J. |
| | 42 | 52 | 40 | 70 | 59 | 72 | 62 | 70 | 59 | 75 | 65 | 57 | 44 | 44 | 30½ | 167 | | 57 | 44 | 61 | 48 | | | 12 | 7½ | 75 | 65 | 48 | 37½ | 25 | 16½ | Weirton, W. Va. |
| | 42 | 52 | 40 | 70 | 59 | 72 | 62 | 70 | 59 | 75 | 65 | 57 | 44 | 44 | 30½ | 167 | | 57 | 44 | 61 | 48 | 12 | 7½ | | | 75 | 65 | 48 | 37½ | 33 | 20 | Wheeling, W. Va. |
| | 81 | 58 | 46 | | | | | 91 | 88 | 94 | 91 | | | 78 | 73 | 184 | | 48 | 37 | | | 76 | 68 | 77 | 71 | | | | | 75 | 65 | Worcester, Mass. |
| | 37 | 57 | 44 | 68 | 56 | 70 | 59 | 68 | 56 | 72 | 62 | 52 | 40 | 40 | 26 | 167 | | 62 | 50 | 57 | 44 | 25 | 16½ | 33 | 20 | 75 | 65 | 53 | 41 | | | Youngstown, Ohio |

*Continued from Page 247*

ucts than has ever been enjoyed by the motoring public."

R. B. **Rausch,** executive vice-president, Willys Motors, Inc.: "Many factors favor a bright future for the automobile industry ... despite today's high inventories.... Naturally there are periods when supply is in excess of demand and a brief adjustment is in order. But that does not mean that industry is overproducing...."

E. R. **Breech,** executive vice-president, Ford Motor Co.: "Ford Motor Co. closed out 1953 in the strongest position in its half-century of existence...."

## MACHINE TOOLS

C. J. **Stilwell,** president, Warner & Swasey Co.: "I expect 1954 to be a year of sustained, normal volume business, with aggressive competition and a wave of product redesign ... major emphasis will be ... on reduction in manufacturing costs."

A. **Lundell,** president, Colonial Broach Co.: "Despite competition from all quarters, demand for broaching machines should continue firm throughout the coming year."

## ELECTRICAL EQUIPMENT

J. F. **Lincoln,** president, Lincoln Electric Co.: "We anticipate during 1954 a level of business activity in the metalworking industry which will permit our firm to maintain normal operations. Whatever slight softening there might be—it might amount to a 10 pct decrease—we expect to offset with vigorous sales activity."

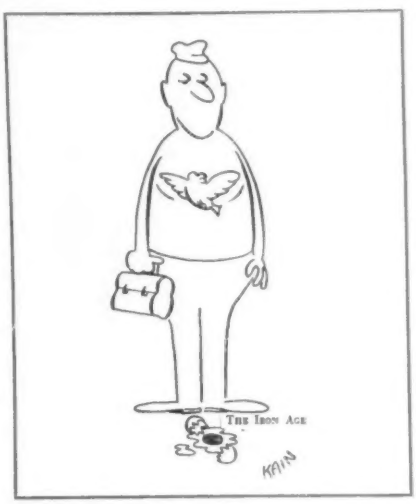
## HEAVY EQUIPMENT

W. A. **Roberts,** president, Allis Chalmers Mfg. Co.: "... Inventories of end products in general have been such that deliveries, meeting customer requirements, could readily be made by not only one but sometimes several suppliers. This is particularly true of farm machinery, motors and construction equipment...."

W. **Harnischfeger,** president, Harnischfeger Corp.: "Sales of industrial equipment may be off 10 pct in 1954.... Construction equipment sales should be good...."

## APPLIANCES

G. A. **Price,** president, Westinghouse Electric Corp.: "... Sales billed of Westinghouse products are expected to reach the highest peak in the company's history in 1954...."




F. **Maytag, II,** president, Maytag Co.: "1954 will be a year of keen competition, particularly in the appliance field. We can expect the level of business to be on a par with 1953."

## TV, RADIO

P. **Galvin,** president, Motorola, Inc.: "1954 looks like the second best year in the history of this company. This means we will have to do better than $170 million worth of business.... The industry will produce about 6 million black and white receivers and about 150,000 color receivers. In consumer radio ... industry should do about 11 million units...."

## CONSTRUCTION

M. H. **Baker,** chairman, National Gypsum Co.: "... overall construction activity ... should be at a level of about $34 billion.... Private construction probably will be off as much as 3 pct, but public construction shouldn't drop much more than 1 pct."

*Turn Page*

## PA's Wax Optimistic for 1954

In appraising the prospects of industry for 1954, purchasing executives showed more optimism than they have been exhibiting in the past few months, reports the National Assn. of Purchasing Agents. Now, PA's believe by a little over 2 to 1 that the gradual decline of production and orders will stop—even strengthen somewhat in the first quarter and through most of the second.

Although the procurement men do not indicate a sharp upswing, their predominant opinion is that business will be sound through that period—though under the '53 rate.

One-third of the purchasing agents surveyed by NAPA saw the mild economic decline continuing, thought further economic adjustments remained to be made. None of the buyers saw a depression shaping.

At the end of '53, industrial activity showed more of a normal seasonal pattern. Business held at November levels through the first half of December but has since shown signs of sharp declines in new orders, accompanied by more output cutbacks. Leveling out, prices give no real show of strength. Employment at the end of 1953 dipped slightly but this was attributed to normal seasonal decline.

**W. Collins,** president, Walter Kidde Constructors, Inc.: "The economy has become more competitive, but no great recession is in sight. This is not 1929."

### PLASTICS

**B. Britton,** president, Carlon Products Corp.: "...plastic pipe sales are going to be fairly good. Sure business conditions generally won't be as good as last year, but I'm not pessimistic."

### COKE, CHEMICALS

**B. Somervell,** president, Koppers Co.: "...For 1954 there are many indications that the level of business will be somewhat lower than during 1953. Koppers, however, does not believe that these indications point to any serious recession."

### HARDWARE

**J. D. Wright,** president, Thompson Products: "I think that 1954 will be a better year than most forecasters seem to think. Thompson Products' sales won't reach last year's record high of over $300 million, but we should make a better profit on a lower sales volume."

### RAILROADS

**W. T. Faricy,** president, Assn. of American Railroads: "...the railroads intend to continue their essential improvement program at the highest level which traffic, revenues and earnings will justify. Expenditures of about $800 million are already programmed for improvements of all sorts. It is thus possible that 1954 will turn out to be another $1 billion year in this field...."

### RESEARCH

**H. A. Leedy,** director, Armour Research Foundation, Illinois Institute of Technology: "The year 1954 will be a big and busy one for industrial research....Industry will rely more heavily upon research to develop the new materials and processes which will improve its products and cut production costs."



# TOOLS: Diversifying Is Mixed Blessing

**Machine tool builders study broadening product mix . . . But there are serious drawbacks . . . Building sales force, learning new field take time, money—By *R. M. Lorz.***

Whenever machine tool sales dip someone is bound to wonder why the industry doesn't diversify. If the question is directed to individual producers they usually say, "We do when it is feasible but it isn't as easy as it looks."

A recent survey by National Machine Tool Builders Assn. showed machine tool plants were undertaking production of everything from abrasive wheels to egg-opening machines. List included about 100 items not ordinarily associated with the industry.

Within the past year one firm has sunk $5 million into a rebuilding plant and another has set up a separate organization to manufacture snow plows for home consumption. There are other isolated examples but informed sources refuse to view them as being representative. Most builders are inclined to go slow about entering new lines requiring radical additions and, most of all, time. But their attitude doesn't spring from reaction.

Instead it is the result of hard thinking which dictates caution. In order to go into a new market tool builders must face at least three major obstacles:

1. A new sales force has to be created or the existing organization diluted;


"I don't care how you do it, but get him out of that line. It doesn't look good."

2. Industrial frontiers still do exist but in most instances diversification involves unequal competition with established firms.

3. Inexperience usually forces merchandising methods through a costly trial and error period.

Everyone agrees that within the past 6 years there has been no startling trend toward extreme diversification. Lack of a major trend in this direction doesn't mean tool builders are passing up any naturals. If a lucrative market can be opened up wide-awake firms won't hesitate to jump. In this respect builders are unanimous in their praise of Detroit's Ex-Cell-O Corp.

Ex-Cell-O currently is reaping a good profit in licensing and making machines to form milk cartons. Although development is not recent firms like Warner & Swasey and Cincinnati Milling have also made the cash register ring by producing textile machinery, earthmoving equipment, grinding wheels and coolants.

In the future firms interviewed by THE IRON AGE say they intend to work actively on diversification outside as well as within their industry. At present the word means more to them when applied to expansion from within.

Sales manager of one firm told THE IRON AGE his company had a long history filled with just this type of diversification. This firm specializes in automatic screw machines. Products introduced recently include dies, threading tools, electrical switches and solenoids.

Machine tool builders anxious to perk up lagging sales are also doing more subcontracting.

Generally speaking forward-looking machine tool builders say it is possible to go far afield in search of new business. But most say they would automatically avoid products subject to the same economic ups and downs as machine tools.

# Auto Industry Faces Acid Test in '54

**Severest test of basic strength seen this year . . . Excellence of product, multi-millions in facilities provide firm foundation . . . Make vast technical strides—By *R. D. Raddant.***

A key automotive figure has called 1954 the most critical year of the decade for the auto industry. So far no one has disagreed with him.

Others have hidden behind such pat phrases as "the return of competition," or "the change from a seller's to a buyer's market." But actually the situation confronting the auto industry has a much deeper significance than these statements indicate.

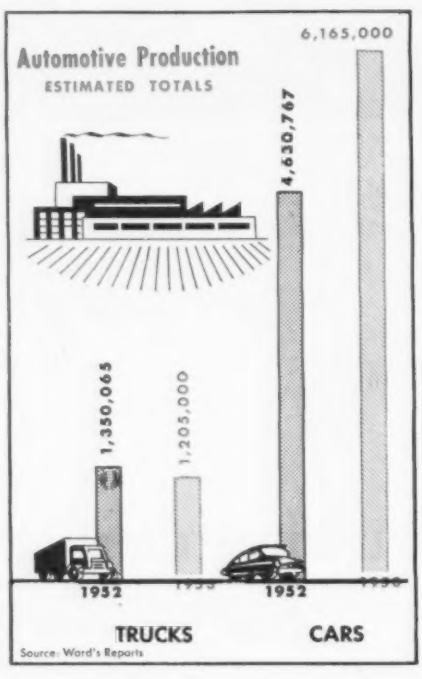
In the next 12 months the auto industry will learn the answer to the question it has hardly dared ask itself: Has it planned and built correctly to meet the challenge of prospering and thriving, providing jobs for its workers and markets for its suppliers in a peaceful and free economy?

**Industry Is Strong . . .** The available evidence indicates it has. Its product is excellent. Never before has a prospective car buyer had such an array of style and quality offered him. Millions in postwar construction and tooling have provided the physical facilities to make autos efficiently and economically. Market researchers have assured the industry that the market is there, but that it may take some digging to develop it.

So 1954 will be a selling year. But that doesn't mean the pressure will be on salesmen alone. Researchers must come up with new developments to offer the public. Stylists have to make them irresistible to the man who is on the borderline of buying. Manufacturers must be able to cut costs for inevitable price competition and purchasing agents must use all their ingenuity in keeping materials and parts costs at a minimum.

**Output Predictions High . . .** The industry had good training in 1953 for the tougher conditions that will confront it in 1954. Last half of the year resolved itself into a tough competitive market. In spite of the complaints of many dealers and comparatively poor showings of a few manufacturers, the industry did an excellent job.

Even in the most cheerful days of late 1952 only flagrant optimists predicted the production that was sustained throughout 1953. The year closed down with approximately 6,165,000 cars and 1,205,000 trucks and buses produced in the U. S., totals far in excess of most industry predictions. It was the second biggest production year in history and the biggest dollar year.




A survey was made recently at a luncheon of automotive writers who, if not experts themselves, had had the benefit of the predictions of the industry's leaders. The writers' composite estimate was for 5,543,000 cars and 1,023,000 trucks for 1954. Traditionally, the auto writers have been pessimists in their predictions.

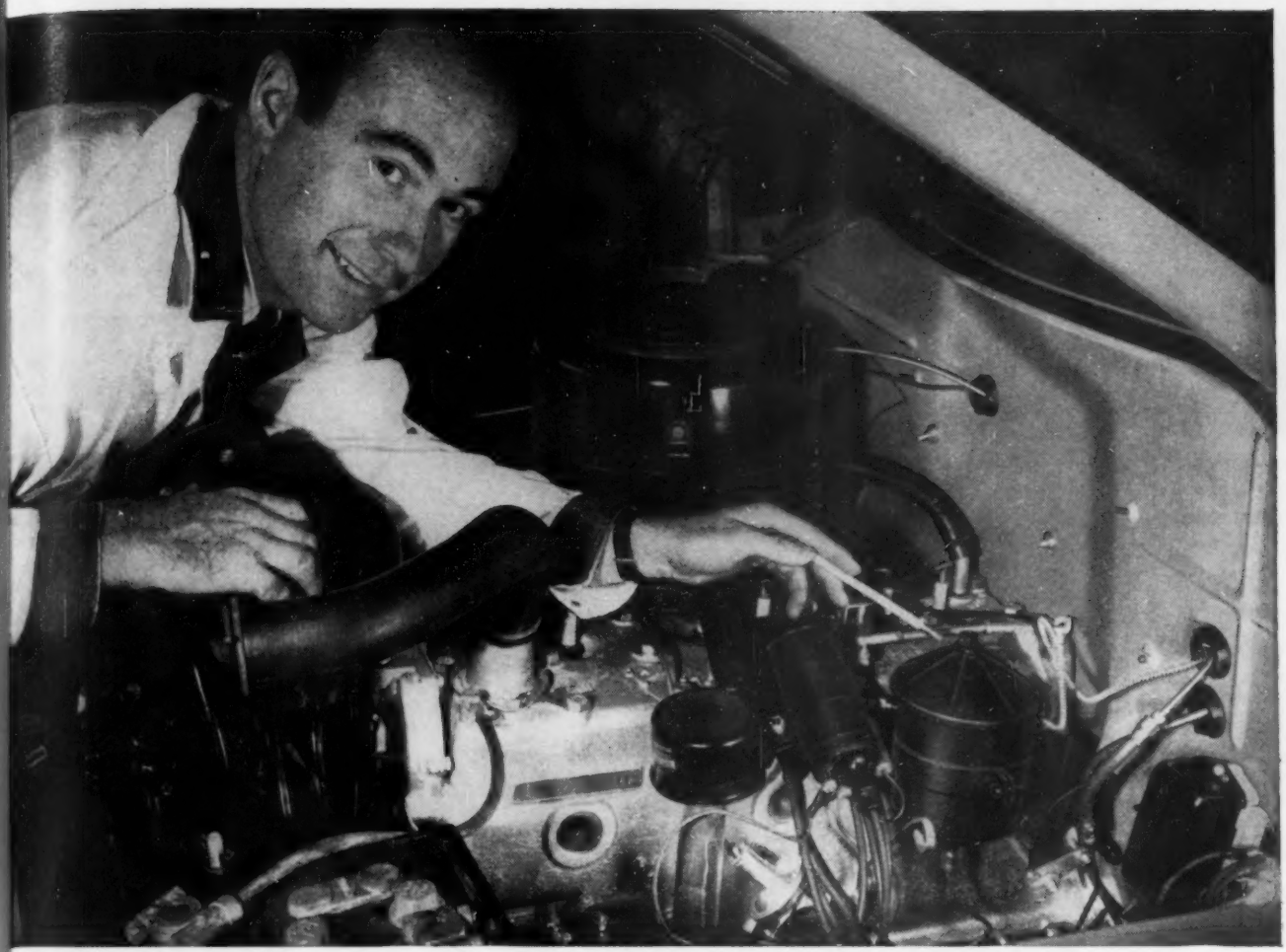
**Use More Plastics . . .** So much for production and generalities. What were the outstanding developments of 1953 and what can be expected in 1954?

In the field of research and development, the use of plastics probably had the greatest advance in 1953. The single event which had the greatest impact on the industry was the Detroit Transmission fire which, in a period of a few minutes, wiped out Hydra-Matic production and brought its users to a virtual halt.

Chevrolet's Corvette brought the first plastic bodied car onto the market, pioneering at the same time in the field of plastic construction and the sports car.

**Truck Parts Next . . .** It has now been established by THE IRON AGE that plastic truck parts will be introduced some time in 1954. Cost of plastic is high and curing time makes it impractical for mass production, but for short runs it can beat the cost of tooling for a metal stamping. Plastic dies, of which much was predicted a year ago, failed to make the anticipated strides. They can't be counted out, but some bugs and cost factors remain to be solved. New plastic uses are for gears and such non-automotive uses as jigs, checking fixtures and similar adaptations.

In auto design, perhaps the



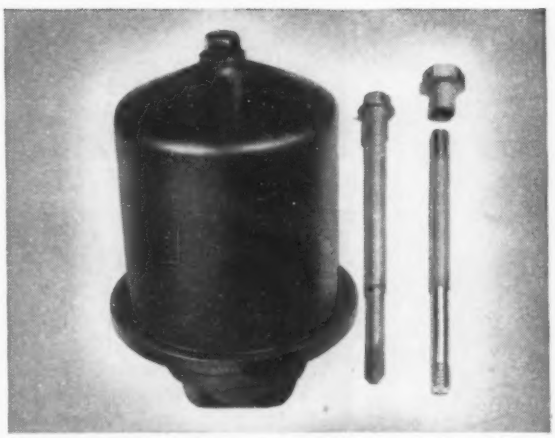
# Here's where Purolator screened out rising costs

• Purolator makes oil filters for a prominent auto maker. They're top-notch filters that do a tough job well. Purolator and the car manufacturer are both proud of them.

Not long ago an RB&W "fastener engineer" got loose in the Purolator plant—just when company production executives were looking for a way to lick rising costs. He noticed that the Purolator filter was being assembled with a two-piece fastener made slowly and laboriously on a screw machine.

Our man told the Purolator people about RB&W's batteries of cold-forming machines. Purolator wanted to know more. Now their filter is assembled with a one-piece RB&W fastener that costs far less to make and assemble.

Chances are you can find a stage in your operations where RB&W "fastener engineering" can help you keep costs in line. As a leading manufacturer of all kinds of fasteners, we're always able to recommend and supply the right ones for all your needs. Write RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY, Port Chester, N. Y.



**EASIER, FASTER ASSEMBLY** undercut high costs when Purolator switched from a two-piece fastener *(right)* to an RB&W-designed cold-formed fastener *(left)* for its famous oil filter.

**RB & W**

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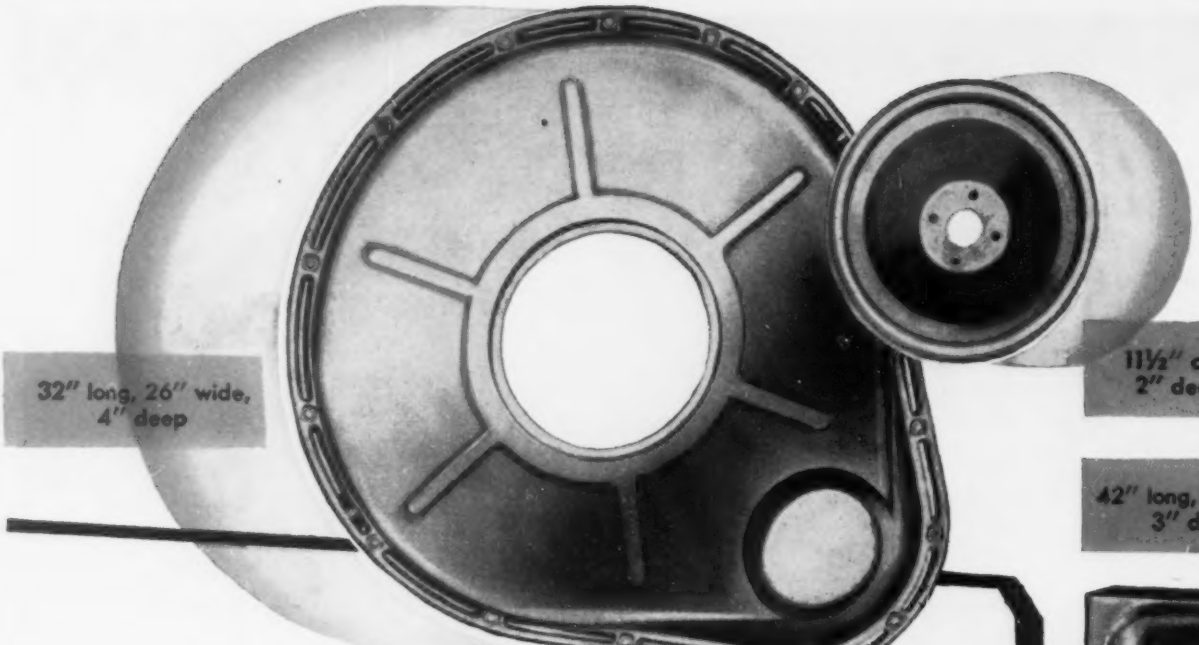

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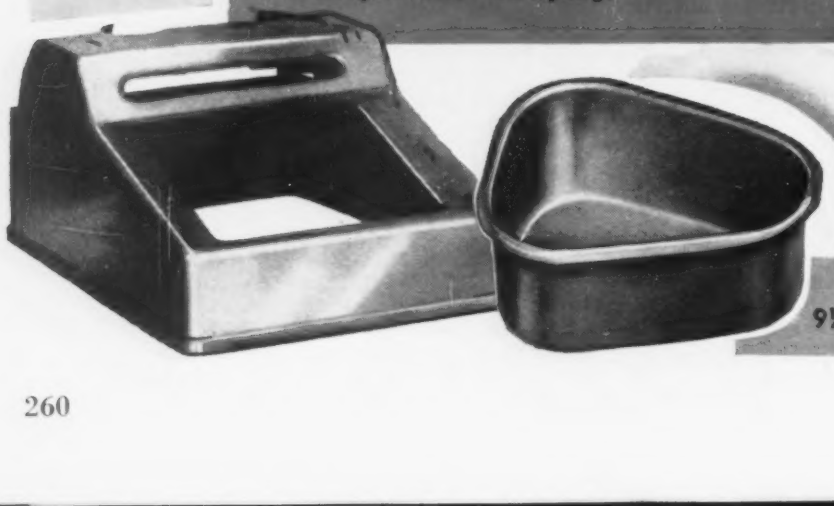

12½" long, 9½" wide, 5½" deep

most significant innovation was the introduction of a model with a transparent panel in the top in both Ford and Mercury lines. This will be tested thoroughly this year on the proving ground of public opinion and whether it is accepted or rejected will have a great deal to do with future design trends.

The sports car market was tapped in 1953 and will be probed in 1954 by the Corvette, Buick's Skylark, which is a real sports car this year and not a cutdown convertible, and possibly others.

**Year of Accessories . . . Too.** 1952 was called the year of accessories because it was in this year that the automatic transmission gained wide acceptance and power brakes, power steering, automatic seat and window lifts and air conditioning came into the market in important volume.

Conceding that the groundwork was laid in 1952, this part of the industry matured in 1953 to the point where many of the once-called extras are now standard equipment. Low-priced lines are now bringing out cars loaded with items originally planned for only the luxury trade. Importance to the motorist is that volume production will push cost down materially.

In manufacturing methods, new strides were made in automation everywhere as the industry bore down on costs. Magnetic paint booths made their appearance. Shell molding remained somewhat of a question mark, but probably because big operations such as Ford's are still kept under wraps.

**In Fire's Aftermath . . .** Big tooling programs were completed as Ford tooled for new Ford and Mercury engines, Buick extended its V-8 throughout all lines, and Pontiac and Chevrolet launched their own programs for new engines by 1955.

General Motors won all industry's acclaim for Operation Hydra-Matic in retooling for production in an incredibly short time after the disastrous Detroit Transmission fire.

By-products were a re-evaluation of fire prevention measures everywhere and the exodus of Kaiser Motors from Willow Run. This spelled the end of Kaiser's attempt to be a factor in the auto industry as Kaiser's auto operations are now confined to the Willys plants which Kaiser purchased during the year.

In addition to Kaiser's buying out Willys and GM's purchase of Willow Run, another big financial transaction was the sale of Briggs Body to Chrysler.

During the year the industry voluntarily opened discussion of its 5-year labor contracts with the CIO. Results were increased pensions, lifting the floor of the escalator clause, an increase in the annual productivity factor and a raise for skilled labor.

**How About Independents? . . .** Looking into 1954, the No. 1 problem concerns the independents. Merger talks and rumors were routine throughout the year as several of them desperately sought a method of pooling resources to gain the advantages of their larger competitors.

It is a safe guess that 1954 will see some results, possibly in combined body operations or combination tooling for a V-8 in which two or more companies could build and use the same block and head, but retain individuality in design and performance features.

A fitting and possibly fearful note to close a year-end roundup is little item that leaked to the public not long ago when a GM vice-president was injured driving a gas-turbine powered car at the proving grounds. This development will be publicly disclosed within weeks, although its tone and direction are subject to speculation. Best guess so far is that a gas turbine car will be part of GM's Motorama.

After the gas turbine, what?

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**THE BULL OF THE WOODS** — **By J. R. Williams**

# Build Stronger Business Base in '54

**Washington will strive for solider U. S. economic base in coming year . . . Aim for lower taxes, more efficiency, less waste . . . But defense has priority—*By G. M. Baker.***

Lower taxes, more for the taxpayer's defense dollar, and a continued withdrawal of government from areas of private enterprise. These are positive points in the 1954 Washington picture affecting business and industry. On the negative side, deficit spending is to continue for at least another 12 months, White House economists ponder means of combatting any sharp slides in sales volume, and military demands for manpower will continue to drain younger workers from every level of industry.

It is significant that Democrats as well as Republicans in Congress are bullish over 1954 business prospects. Although there is speculation on both sides of the political aisles that sales, production and earnings may decline slightly this year, there is general belief that 1954 will be a year of better and sounder business performance.

Consumer expenditures are to continue at a high level, and are to be bolstered by a high level of personal savings, high employment, steady growth in population. Pattern of business generally is not expected to change to any marked degree.

**Private Enterprise . . .** Getting the Federal Government out of competition with private business is to continue as a prime target of the Eisenhower Administration. A start was made in this direction last year, with sale of the government's inland waterways barge service, and enactment by Congress of legislation designed to take the taxpayer out of the synthetic rubber business.

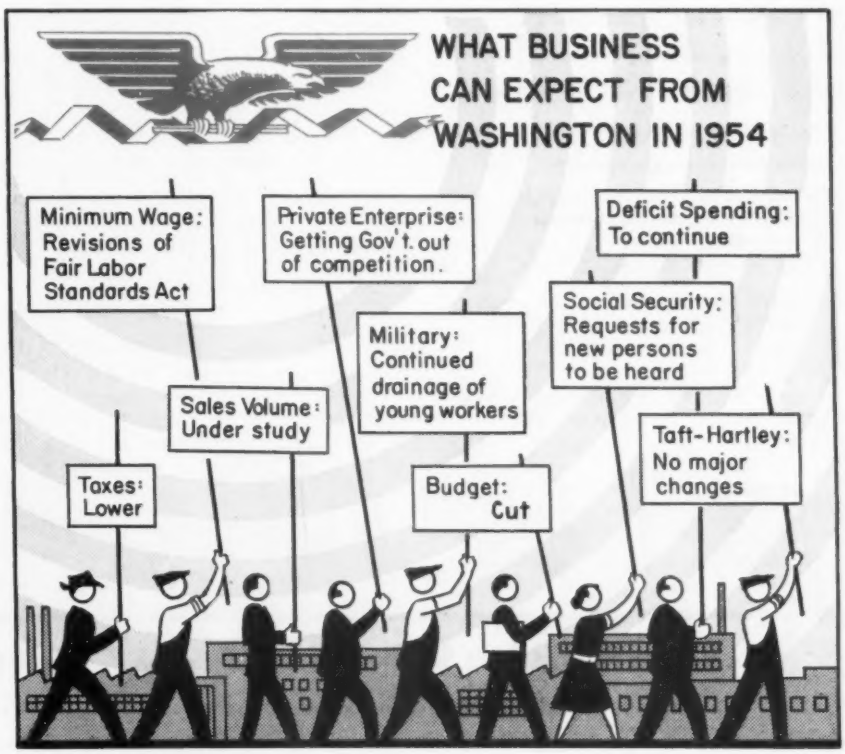
This year's program is more promising. Several congressmen are drafting bills to permit industrial development of atomic power. Secretary of Defense Wilson has, in effect, ordered the Army, Navy, and Air Force to divest themselves of their metal scrap processing operations—instead allow private dealers to prepare the material.

Each of the military services is under firm orders to sell or dispose of its surplus inventories of all types, thereby releasing much valuable warehouse space to the needs of industry. Interior Dept. is pursuing a policy of encouraging private development of water resources and power facilities to meet already critical needs of many industries, U. S. communities.

**Taxes . . .** Full details of the Administration's tax program are due for disclosure within the next few days. It now seems clear that Treasury Secretary Humphrey will not oppose the automatic drop (average: 10 pct) in individual income tax rates that became effective on Jan. 1. As a result, he is not expected to ask that this reduction be retroactively cancelled.

Outlook for reduction in corporate tax rates is colored by many political angles. Some observers believe Mr. Humphrey will ask that the cut scheduled for Apr. 1 be postponed indefinitely. If so, he will find plenty of opposition within the Congress. Two likely compromises are now under discussion at the Capitol for presentation to Congress.

One alternative: Continue the corporate tax rate at 52 pct. Continue all excises, with the exception of those applying to jewelry, cosmetics, luggage, furs, and movie admissions. Cut each of these from



# ARMSTRONG'S INSULATING FIRE BRICK AND CEMENTS

**INSULATING FIRE BRICK.** Strong insulating fire brick usually have comparatively low insulating value, while brick that are efficient insulators many times lack high strength. Yet in most insulating fire brick applications, a combination of both these physical properties will result in better furnace performance.

Armstrong's Insulating Fire Brick are made to give you a well-balanced ratio of both these vital properties. This is made possible through the use of stronger clays and Armstrong's special cork burn-out process. Cork does not reduce the plasticity of bonding qualities of clay in the wet mix—clays can be used in the best proportions to give greatest strength. Air spaces left when the cork particles burn out in the firing process give these brick their high insulating efficiency.

Armstrong's Insulating Fire Brick are light in weight, uniformly sized, and offer high resistance to shrinking and spalling. They safely withstand the damaging effects of special atmospheres and can be used directly exposed in equipment fired with gas, oil, electricity, or powdered coal.

**REFRACTORY CEMENTS.** Armstrong's C199 Cement is an air-setting refractory mortar ideal for use with all types of fire clay brick and with insulating fire brick. A joint of C199 cement is actually stronger than the average fire brick it bonds! It takes a firm set at room temperature and maintains this strength over its entire working range. It is highly resistant to abrasion, slagging, and spalling—has sufficient refractoriness to meet all A.S.T.M., A.R.I., and U. S. Navy standards for superduty mortar at 2910°F.

**Armstrong's No. 26 Bonding Mortar** provides a bond of moderate strength. It is well suited for applications where a stronger bond is unnecessary—it develops a comparatively strong bond when exposed to temperatures over 1800°F. It is also recommended for laying up insulating fire brick as back-up insulation, allowing the brick to be salvaged for reuse.

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| TYPE | A-16 | A-20 | A-23 | A-25 | A-26 | A-28 |
|---|---|---|---|---|---|---|
| Maximum hot face temperature | 1600°F. | 2000°F. | 2300°F. | 2500°F. | 2600°F. | 2800°F. |
| Flexural Strength (Lbs./sq. in.) Test Method: A.S.T.M. C93-39T | 120 | 70 | 210 | 105 | 225 | |
| Compressive Strength, minimum (Lbs./sq. in.) Test Method: A.S.T.M. C93-39T | 175 | 175 | 430 | 250 | 325 | 234 |
| P. C. E. No., minimum Test Method: A.S.T.M. C24-35 | 29 | 29 | 31 | 29 | 33 | 36 |
| Corresponding Softening Point | 2984°F. | 2939°F. | 3056°F. | 2984°F. | 3173°F. | 3290°F. |
| Weight per 9-inch straight. Lbs. maximum | 1.85 | 1.90 | 2.75 | 2.35 | 2.80 | 3.25 |
| Weight, lbs. per cu. ft. maximum | 31.6 | 32.4 | 47.0 | 40.2 | 47.8 | 55.15 |
| Spalling Loss—Average per cent | 0.25 | 3.0 | 5.0 | 9.0 | 5.0 | 15.0 |
| Shrinkage, Linear change per cent at maximum hot face temperatures (maximum) Test Method: A.S.T.M. C93-39T, for 24-hour period | 0.5 | 1.10 | 1.75 | 2.00 | 2.00 | 2.00 |
| Conductivity, Btu. per. sq. ft. per hr. per in. thickness at max. mean temperature | | | | | | |
| 400°F. | .890 | .846 | 1.620 | 1.253 | 1.753 | 2.292 |
| 1200°F. | 1.362 | 1.532 | 2.543 | 2.140 | 2.532 | 2.945 |
| Test Method: Guarded Hot Plate Method | | | | | | |


**ARMSTRONG'S INSULATING REFRACTORIES**

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20 pct to 10 pct. Vote an additional 5 pct reduction in individual income tax rates.

The alternate tax strategy: Postpone all excise reduction, any "bonus" individual tax reduction, and reduce the corporation rate from 52 to 50 pct.

**Budget** . . . The Administration takes the view that a balanced budget is out of the question in the new fiscal year. The goal is in sight, as Treasury Secretary Humphrey sees it, but attainment of it has been postponed until fiscal 1956. Mr. Humphrey says frankly that defense expenditures are the reason. But, he cautions, "we cannot swing a broad ax in cutting these expenses, if by so doing it affects the security of our country." His attitude reflects the mood of Congress.

Spending can be trimmed only as consistent with maintaining a defense adequate to meet the dangers which confront the U. S., he believes. And the next 12 months are not a period in which defense programs can be sharply cut, he warns. Fiscal 1956 will terminate in a presidential election year, and the Administration's current plan is to bring spending and income into balance just prior to the presidential elections.

**Taft-Hartley** . . . Don't expect major changes in Taft-Hartley Act this year, despite heavy pressures building up outside legislative offices. Any governmental steam for broad revision must generate at the White House.

Congress is cool to bringing up major labor proposals, such as repealing state rights to prohibit union shop and other forms of compulsory unionism. It is too likely to touch off drawn-out, probably bitter controversy unwanted by Congress this year. Not much pressure is likely to be exerted by the White House. Explanation may be given that the law should be allowed another full year of operation, in order to reveal bugs to Administration experts assigned to such a study.

A White House spokesman outlines revision policy generally as aiming for "a program which will justify our going before the people." Key goals under this policy are (1) to remedy defects which tend toward union-busting activity and (2) insure the right to organize but guard industry's non-union workers.

**Minimum Wage** . . . The Administration may be expected to throw its full support behind proposals for sweeping revision of Fair Labor Standards Act, partly to lift some of the pressure for revision of Taft-Hartley. Basic proposal is to revise upward the present statutory minimum wage of 75¢ an hour. Labor itself wants the new floor at $1.25 an hour and several bills proposing this minimum are in the mill.

Of equal concern to business is a proposal to eliminate most of the existing exemptions, bringing virtually every business within the scope of the law. Impact would double with lifting of exemptions. Industries now covered generally pay higher than statutory minimums, but business sources say inclusion of all business is likely to trigger new wage demands.

**Social Security** . . . Workers who want federal old-age benefits and who are not now eligible for Social Security will have their big chance to state their case to Congress.

Forum for pleading the case is being provided by Chairman Reed, R., N. Y., of the House Ways & Means Committee. He will hold public hearings on the Administration's request that about 10,500,000 new persons be brought under Social Security coverage. His view is that coverage should be extended to any group desiring it—assuming that such an extension is administratively feasible.

Mr. Reed is convinced that a change is needed in the "work clause" under which a person loses Social Security benefits in any month in which he earns $75 or more. He wants to liberalize this part of the law. Rise on Jan. 1 of the payroll deduction tax from 1½ to 2 pct on employers and employees alike is bound to touch off a hot fight.

**Military Manpower** . . . Chances for the latest plan for Universal Military Training to become law this year are dim. As the Pentagon manpower expert, Dr. John A. Hannah questions the estimate that up to 2 million men may be available for military training by 1960.

He is sticking by his December statement that the dwindling manpower pool may reach an even lower level in a couple of years. He looks for a reverse trend later, but says 1960 will be the first year in which the U. S. will have on hand 1 million men of minimum draft age who can meet minimum military standards. This factor in itself, he believes, puts the nation in a poor position to install UMT.

Aside from this important objection, Congress has one of its own. The lawmakers don't like the idea of having the draft and UMT operating side by side, as called for in the plan. They see the draft as a standing device to which the voters have become accustomed. On the other hand, they don't want to tack on a UMT system and anger countless parents with elections coming up next fall.

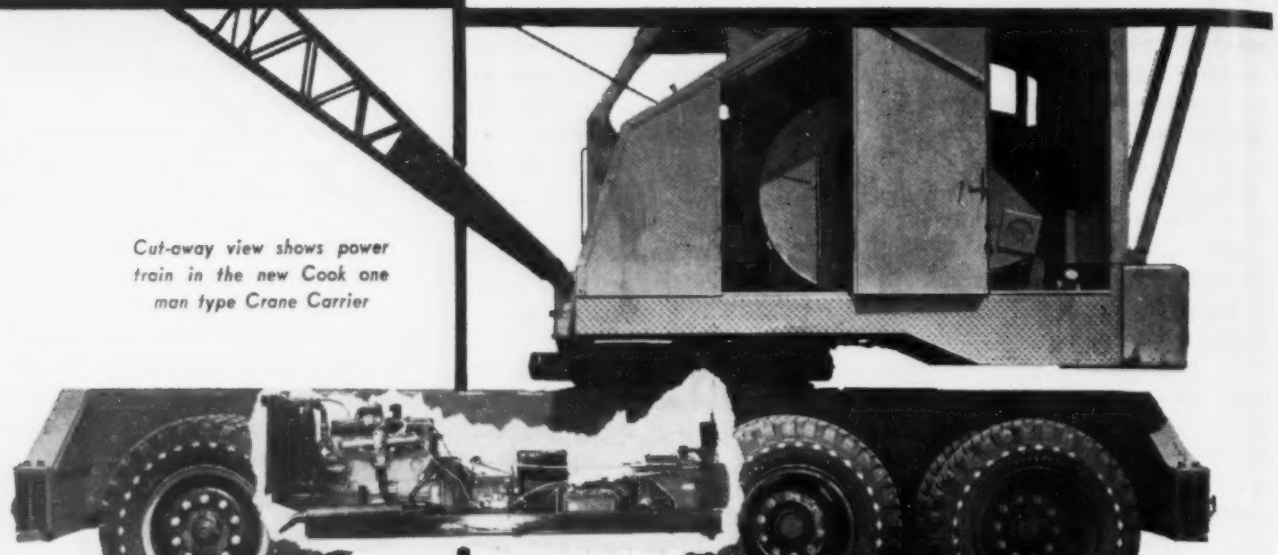
## Plan Delivered Price Action

**Congressional moves to clarify the legality of delivered prices will rate a high priority in 1954.**

**Both Senate and House members are being alerted to the need for legislative action in this direction. Under present plans, Congress will pass—and Ike will approve — legislation making it crystal-clear that any manufacturer may quote delivered prices on his products, provided the prices are arrived at in the absence of collusion and are established in good faith to meet competition.**

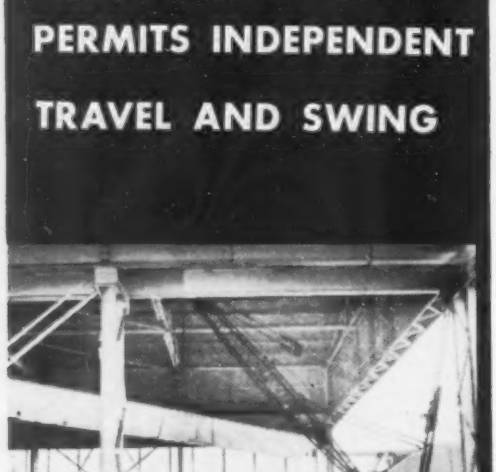
# NEW COOK CRANE CARRIER

## ONE-MAN-TYPE FOR 25-TON CLASS



*Cut-away view shows power train in the new Cook one man type Crane Carrier*

## Independent Power PERMITS INDEPENDENT TRAVEL AND SWING



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That's the big feature of the new one-man-type Cook Crane Carrier . . . a combination self-propelled and truck type! . . . designed specifically for all make cranes in the 25 ton class.

In addition, this great new carrier features hydraulic power steering and air brakes, yet without air or oil lines between carrier and crane. All carrier controls are by mechanical linkage. Investigate this new unit now . . . available as either new and original equipment or for mounting used machines.

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**COOK BROS.**
**EQUIPMENT COMPANY**
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Los Angeles 65, California
**Crane Carrier Division**

# Confidence Keynotes Coast Industry

**Western metalworking looks for solid business year in '54 . . . But hectic pressures of '53 will be lacking . . . Steel industry modernizes to meet competition—By T. M. Rohan.**

Western metalworking started like a ball of fire last year, cooled down somewhat in late third and fourth quarter, but faces a good normal year for 1954.

Extreme optimism prevailed for first half '53 and production reached alltime highs in most fields. Through the third quarter, however, despite marked apprehension by many, production stayed at or near capacity.

Not until late third quarter did the slip begin to show at producer level. Even then for most it never got so bad as expected. At year's end when the figures were totted up, almost all found they had racked up a banner year.

**Stress Efficiency, Competition . . .** Most manufacturing firms expect to put their house in order during 1954 with a view toward increased efficiencies and lower operating costs. Types of products will also be extended to meet individual customer requirements. More attention will be paid low volume products and specialties.

Competitive selling with price a major pivot point will also get going in earnest. Possibility of a heavy letdown in overall western industrial production does not seem to be in the cards. But the downward trend will probably continue until a leveling-off period is reached.

**Mills Keep Busy . . .** In the steel industry operations hovered between 86-89 pct of rated capacity at year's end. Aluminum output representing about 45 pct U. S. production hit alltime highs due to heavy demand and no power interruptions. Aircraft production has at least 2 good years ahead.

Largest steel producers have fairly heavy first quarter books. Smaller bar-size mills which are large in number but tonnagewise a smaller factor are living a hand-to-mouth existence. Manufacturers' inventories have been whittled heavily and very short term ordering is widespread. But even smaller mills keep going steadily.

**Expansion, Highways Promising . . .** Announcements of total capital investments in California in 1953 hit $490 million, down 20 pct from 1952 when steel mills, aircraft and other defense connected expansions were heavy. A good portion of this will materialize in 1954. California road construction budget, highest of any state in U. S. history, promises good bar business.

Within the seven western state area, steel mills turned out 5,224,500 tons of ingots in 1953 according to an IRON AGE mill-by-mill check. This is 8 pct over the previous record year of 1951 and an average operating rate of 93 pct. This year mills expect to pour 4,598,000 tons in the seven-state area or 88 pct of capacity. But new increased rated capacities this year will lower the rate a few points.

"Good to see you back! How was that California sunshine?"

**How Mills Feel . . .** Jack Ashby, Kaiser Steel vice-president, told THE IRON AGE: "Steel demand here in the West appears to be quite firm for the next several months—particularly in flat rolled products. With the transition from a sellers' market to a buyers' market, competition will be keen. We intend to meet this with increased production efficiencies, close analysis of quality, service and price."

Colorado Fuel & Iron Corp. is highly optimistic, especially on seamless tubing from its new $30-million tube mill dedicated in October. This and a continuing good rail and structural market are expected to absorb slump in wire operations.

U. S. Steel Columbia-Geneva Div. is still going full speed at Geneva Works and this year may finally reach a leveling-off in demand for plates. Wide flange beams will probably be only item in short supply by midyear.

**Tinplate Demand Heavy . . .** Sustained heavy demand for tinplate is expected. If canning of soft drinks started this year in Wyoming catches on, demand could be hot. An influx of Milwaukee and other breweries into California also promises increased tinplate demand. For the first time in history, western tinplate production at Pittsburg and Fontana exceeded imports from other areas by about a 5 pct margin. Total seven western state consumption is about 875,000 tons—about 15-20 pct of all U. S. production.

The three Bethlehem-Pacific mills are in for a general overhaul which will increase capacity from present 900,000 to about 925,000 tons. Seattle and San Francisco will both get a newer and larger replacement furnace each and general product range will be extended.

# A LATHE IS BORN...

## AXELSON'S OWN FOUNDRY ASSURES A PRECISE AND RUGGED OFFSPRING

An Axelson lathe starts its long life under the watchful eyes of Axelson's own foundry experts. This means specifically, quality control begins at the beginning – in the lathe bed itself. Axelson's 40 years of lathe production is backed by even longer experience in foundry practice (1892). Every bed is *underground cast*, way side down, to insure closest possible grain structure and to achieve natural annealing and aging. Important, too, is the fact that all other cast parts, such as the carriage, the headstock case and cover, the tailstock body and block, receive the same rigid quality control. By operating our own foundry, much higher than normal specifications can be indicated—*and met*. Thus, when we say at Axelson "A Lathe is Born," it is meant literally. At Axelson it is the offspring of experts – from the ground up.

HERE IS A PARTIAL LIST OF AXELSON LATHE USERS: ALUMINUM COMPANY OF AMERICA BOEING AIRCRAFT COMPANY • CALIFORNIA INSTITUTE OF TECHNOLOGY • CESSNA AIRCRAFT COMPANY CHRYSLER CORPORATION • DEERE WATERLOO TRACTOR WORKS • DOUGLAS AIRCRAFT COMPANY DOW CHEMICAL COMPANY • E. I. DU PONT DE NEMOURS & COMPANY, INC. • FORD MOTOR COMPANY GENERAL ELECTRIC COMPANY • HUGHES TOOL COMPANY • SOUTHERN PACIFIC RAILROAD UNITED STATES NAVY

AXELSON MANUFACTURES LATHES IN THE FOLLOWING MODELS AND SIZES: ENGINE LATHES, 16" H. D., 21" H. D., 25" H. D., 25" H. D, 32" H. D.; PRECISION TOOL ROOM LATHES, 16", 20"; GAP BED LATHES, 32"/108", 32"/125"; HOLLOW SPINDLE LATHES, 25" WITH 6-3/4" HOLE, 25" AND 32" WITH 11" HOLE. 32" HOLLOW SPINDLE LATHE ALSO AVAILABLE IN GAP MODEL. ALL LATHES ARE FURNISHED IN VARIOUS LENGTHS AND WITH A WIDE RANGE OF TIME-SAVING ACCESSORIES.

**AXELSON** MANUFACTURING COMPANY DIVISION
**PRESSED STEEL CAR COMPANY, INC.**
LOS ANGELES 58, ST. LOUIS 16, NEW YORK 7, TULSA 1

PSC

BOX CARS • HOPPER CARS • GONDOLA CARS • REFRIGERATOR CARS • STANDARD PARTS DAIRY CANS & EQUIPMENT • SELF-CLOSING WASTE RECEPTACLES • PERMANENT STAINLESS STEEL COOKWARE • AUTOMOBILE ACCESSORIES • FARM HOLDING TANKS STORAGE HOPPERS • ALLOY STEEL CONTAINERS • OIL STORAGE TANKS • RENDERING & SOFTENING TANKS • RESIDENTIAL FUEL OIL TANKS • AGITATORS • SMOKE STACKS • DUST COLLECTORS • COAL & ASH HOPPERS • LOCK NUTS & BUSHINGS • COUPLINGS & CONNECTORS FITTINGS & ELECTRICAL ACCESSORIES • ORDNANCE MATERIEL • UNISHELTER RELOCATABLE HOMES EXPORT ONLY: LOCOMOTIVES & TRACKWORK • MINE & ORE CARS • UNISTRUT METAL FRAMING CANE CARS • INSPECTION CARS • WEED BURNERS • BRICK & TILE MACHINERY • CANE LOADERS

LATHES: ENGINE • TOOL ROOM • HOLLOW SPINDLE • GAP BED • PETROLEUM PUMPING EQUIPMENT: DEEP WELL PLUNGER PUMPS • SUCKER RODS • HYDRAULIC LONG STROKE PUMPING UNITS • AIRCRAFT COMPONENTS

# Market's Downward Spiral No Tailspin

**Shipments will dip from 1953's $1.2 billion to around $800 million . . . Defense, replacement market will prevent severe slump . . . Tax help expected—By *E. J. Egan, Jr.***

Machine tool industry won't have its back to the wall in 1954, but it will have to fight harder for new business than it has in the past 3 years. Total shipments for the year just beginning will probably run around $800 million industry sources estimate. In 1953, domestic and foreign shipments of U. S. machine tools were slightly less than $1.2 billion, about par with 1952.

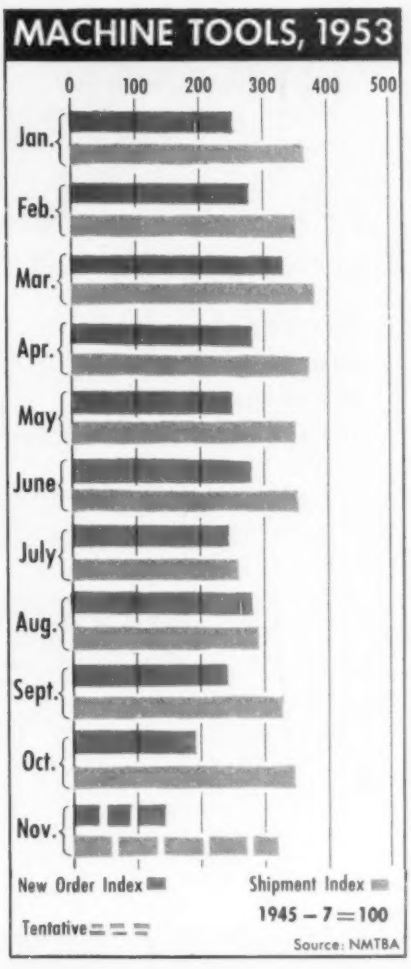
New orders have lagged behind shipments since September of 1952. Thus overall backlog for the industry, which stood at 11 months a year ago, dropped to 6½ months at the close of 1953. This trend may continue downward for a while, but a definite upturn is expected before many months go by.

**Won't Slump . . .** No one believes the machine tool business will go into a slump. Basic productive capacity built up during the Korean emergency will be kept operating at a healthy rate. Some subcontracting facilities will undoubtedly be eliminated, and overtime work will be curtailed here and there. But there will be no large scale layoffs.

Defense requirements should help keep machine tool builders busy this year. Barring resumption of fighting in Korea or elsewhere, defense should account for about 10 to 12 pct of new orders this year, and for several years to come.

**Flemming Promised . . .** Tools purchased by the government and the military will be used to expand and maintain a broad mobilization base under which facilities and tooling will be continually adjusted for maximum preparedness. The machine tool industry received this assurance from ODM Director Arthur S. Flemming just 2 months ago at the annual Fall Meeting of the National Machine Tool Builders' Assn.

Brightening the sales outlook for this year is the fact that a shortening of delivery periods on machine tools will tend to reverse the downward trend in new orders.




Guarantees of quick delivery on late models will continue to encourage civilian manufacturers to buy new and replacement machine tools and equipment.

**Replacements Needed . . .** A great deal of attention has been focused on the many thousands of obsolete machine tools in use throughout the country. Arguments for replacement will find an increasing response as keen competition for civilian markets makes the producer of consumer goods more cost conscious.

Action by the new Congress may also improve business prospects in '54. Machine tool builders and many of their prospective customers are expecting favorable legislation which would provide liberalized depreciation allowances on purchases of metalworking equipment. Just what form this tax help might take can't be predicted, but some encouragement in this direction is anticipated.

**Exports Won't Rise . . .** Prospects for an increase in exports of U. S. machine tools are not particularly promising. This market accounted for 7 to 8 pct of the industry's total shipments during the past year and is expected to remain about the same for some time. Intense competition from foreign machine tool builders is apparently here to stay. It will continue to edge the U. S. out of overseas markets because of lower prices, binding trade and licensing agreements, and the dollar shortage.

But loss of export business for American builders will be offset somewhat by a slowdown of foreign machine tool imports by the U. S. Prompt delivery of American equipment, adequate, convenient stocks of replacement parts, and close-at-hand technical and service assistance are expected to make bargains from European sources somewhat less attractive than they have been.

# REPORT TO MANAGEMENT..

**Support in back of us**

Launching and supporting continuing business prosperity in 1954 is the greatest production-consumption year in history. In 1953 the boom crested but the dynamic forces that nurtured it cannot suddenly abate. Such economically muscular factors as high rates of income, construction, capital outlays, defense, employment, sales have sufficient impetus to keep the '54 economic pulsebeat going like a triphammer. Because several major industries are certain of moderate cutbacks this year, it does not seem possible that 1954 will equal 1953 in production volume. Sum of these mild setbacks may cause a downtrend of over 5 pct in national product for '54. Although industry now has ample basis for optimism, heavier competition is certain. It will spring not so much from retreat of the consumer from the marketplace but because industry's expanded productive capacity can overstock its market. This year will mainly be noted for the mass maneuvering of manufacturers to adjust output to demand.

**The air's still thin**

The economy is leveling off to a cloud-high plateau. This page has been maintaining that industry has already undergone much of its adjustment from boom in the areas of inventory, materials procurement and more accurately notching down output to demand. Since consumer purchasing through the last half of 1953 held fairly stable, the gentle production downslide can thus be attributed to industry's internal transition. A moderate resurgence is now possible in some manufacturing areas.

**The day the boom blunted**

Sometime in '53, the swelling ability of industry to produce, aided by death of almost all materials shortages, overtook and slightly outstripped demand. At that point the up-spiral of the boom was blunted. Many industries eased output a trifle. Others had such production impetus that too many finished products were thrust into inventory and they later had to correct output with layoffs. Taking a light swipe at national output, mass paring of materials inventories became possible in a new climate of dissipated shortages. Delivery time shortened drastically.

**Budget is bleeding—slightly**

Politically aware that abrupt withdrawal of too much defense money can slug the economy, Washington is cutting back very prudently. Total budget should total $67 billion--about $5 billion under the current one, with perhaps $3 billion stricken off defense spending. Government spending can be considered a declining prosperity factor and sooner or later the consumer will be faced with taking up a growing spending slack.

**Patent pocketbook**

Since the consumer is a kingpin of the economy, his pocketbook will sustain a high level of good times in '54. While other business indicators eased late in '53, personal income held almost rigidly stable. What industry must worry about more than any decline in income is the change in the consumer's buying attitude. Influenced no doubt by an abundance of products and with a spending splurge in back of him, the buyer is subtly altering his attitude to one of passivity rather than aggressiveness. Witness his braking the rise of his installment debt and his increased rate of savings. He will not be reluctant to buy but he must be coaxed by product improvements, promotion, advertising. Stimulating the consumer to buy is industry's largest challenge this year. With about $200 billion in savings, other accessible money in the consumer's hands, there will be no dearth of cash to lubricate industry's wheels. Strategic prosperity props such as construction and capital outlays will remain strong in '54--though they will ease as the year wears along.

# A.W.

## CONTINUOUS MILL

**PLATE • SHEET • STRIP—*available in hot rolled quality***




*More than a century and a quarter of iron and steel making experience.*

The quality of Alan Wood Steel is of prime importance to both our customers and ourselves. Our Continuous Mill produces steel from .059″ to .500″ to a maximum width 25½ inches, furnished in coils or cut lengths as required. Rigid metallurgical control means that you get *what you want!* Years of steel making experience plus our mine-to-mill undivided responsibility assures you the best quality steel possible to produce.

Because we're located in the heart of the East's great industrial and transportation area, we can often make faster delivery.

**ALAN WOOD STEEL COMPANY**

**CONSHOHOCKEN, PA.**

ONE OF A SERIES OF ADVERTISEMENTS ON THE HISTORY OF ELECTROPLATING

## a midnight sale that opened **the door to new plating profits**

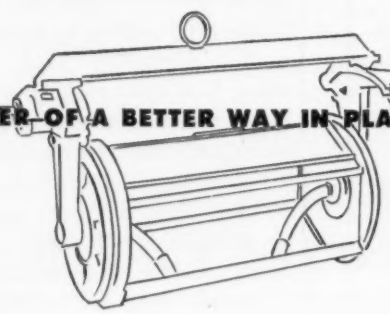
Back in 1934, Udylite's young president, L. K. Lindahl, threw the necessary parts for a complete plating barrel into his car and headed for Kokomo, Indiana. He arrived at midnight. His prospective customers – a plating shop owner and the superintendent–were waiting for him.

On the shop owner's desk, Lindahl assembled, disassembled and reassembled the barrel. It was a perfect machine fit of parts picked at random from stock. It was the first barrel providing perfect assembly of standard parts! Easily removable panels and other superior features of the barrel completely sold both men. Udylite got the order!

The months of research by the Udylite technical team had paid off! The barrel was unique because it was made from a material heretofore untried . . . hard rubber. In addition, electricity was conducted through the ends of the barrel by easily removable contacts. This first Udylite Barrel had again provided *a better way* in plating.

Udylite knew they had the best unit in the industry –one that upped production, cut costs, saved manpower. But the "midnight sale" proved the acceptance and value of this revolutionary product.

In the following years, Udylite Corporation continued to pioneer improvements and innovations in plating barrels. Bakelite, hard rubber and melamine materials were followed by the present super-resistant lucite plating cylinders. But that's not all! Udylite engineering and research teams are constantly at work perfecting still better materials, methods and equipment . . . all designed to give you better plating at lower cost.



PIONEER OF A BETTER WAY IN PLATING...

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

## —Free Publications—

### Electric hoists

New bulletin describing line of lightweight Liftabout Jr. electric hoists has been issued by Shepard Niles Crane & Hoist Corp. Designed for intermittent duty, the Liftabout Jr. is a compact, planetary gear, wire rope type hoist. It is available in following capacities, 250, 500, 1000 and 2000 lb, and can be furnished either parallel or cross-mounted, with bolt, hook or trolley suspension. *Shepard Niles Crane & Hoist Corp.*

**For free copy circle No. 12 on postcard, p. 273.**

### Electrodes

Booklet entitled *Improved Standards of Electrode Performance* has been issued by Electrode Div., Great Lakes Carbon Corp. Pointing out that the cost-per-ton of steel is directly related to electrode consumption, the booklet discloses the results of studies made by Corp.'s electrode specialists on the effects of tighter joint assemblies to efficient electric furnace operations. Booklet features illustrated list of approved practices in adding electrodes to the column. *Great Lakes Carbon Corp.*

**For free copy circle No. 13 on postcard, p. 273.**

### Research, testing

New brochure issued by Bowser Technical Refrigeration illustrates and describes that company's line of research and testing units. Standard units described have test spaces ranging from 4 to 36 cu ft. All models are of the self-contained type, ready for plug-in operation and are available with humidity feature. *Bowser Technical Refrigeration.*

**For free copy circle No. 14 on postcard, p. 273.**

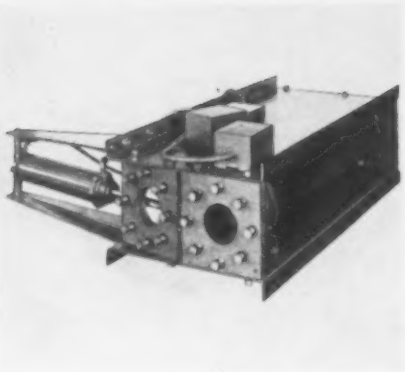
### Seamless tubing

*Summerill Tubing* is title of recent booklet available from Columbia Steel & Shafting Co. Booklet gives sizes, working pressures, specifications and other engineering data on all types of company's seamless tubing. Special pages are devoted to hydraulic, pressure, mechanical, diesel, special and aircraft tubing. *Columbia Steel & Shafting Co.*

**For free copy circle No. 15 on postcard, p. 273.**

# NEW EQUIPMENT

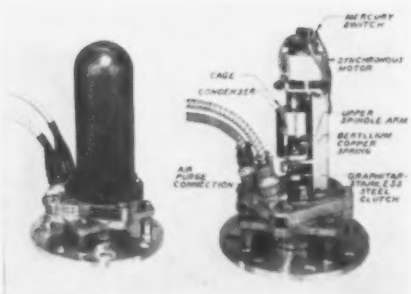
**New and improved production ideas, equipment, services and methods described here offer production economies . . . just fill in and mail the postcard on page 273 or 274.**



## Pipeline system for moving foundry sand

A pneumatic pipeline system for moving foundry sand has three main components: transporter, pipeline, and the transfer switches, all engineered and installed as a complete system to meet individual foundry requirements. Capacity of the system is determined by the transporter, which is available in three sizes: 7½, 15, and 30 cu ft. The other main components needed are determined by the number of stations to be served. Advantages include: foundry sand delivered exactly where needed, as convenient as water from a faucet; instant push-button control by one man from a central operating panel; simple standardized components lessens investment costs. *Whirl-Air-Flow Div. Gerwin Industries, Inc.*

**For more data circle No. 16 on postcard, p. 273.**




## Continuous indication and control of viscosity

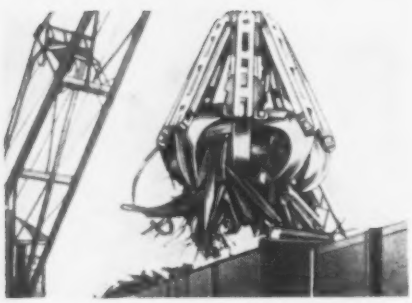
Viscometran, a flexible and rugged industrial instrument, provides accurate and continuous viscosity measurement of materials in process. Its practical method can assure better product uniformity and quality. Viscosity is measured at a constant rate of shear. The instrument may be used for applications involving base mount temperatures up to 200°F and in a vacuum from 8 mm of mercury to pressures of 100 psi. All moving parts are mounted on rigid aluminum castings and enclosed by a 3/32 in. steel valve cap. *Brookfield Engineering Labs., Inc.*

**For more data circle No. 17 on postcard, p. 273.**

## Tracer tool adaptable to lathes 16 to 24 in.

Simple, compact precision duplicating attachment adaptable to medium size lathes is all-mechanical, having no complicated electronic or hydraulic mechanisms. Installation is quick and simple. The lathe compound is removed and the tracer tool is mounted directly on the cross slide. It has a horizontal slide operating between two rows of ⅜ in. pre-loaded ball bearings, eliminating all slap and side play. Positive contact between the stylus and a ¼ in. template is assured by air pressure applied to the tool through a pressure regulator and a four-way valve which are furnished. Shop line air pressure is sufficient. *Lehigh Foundries, Inc.*

**For more data circle No. 18 on postcard, p. 273.**



## All-purpose grapple doubles scrap lift load

The Scheidt grapple is produced in capacities ranging from 0.4 to 3.3 cu yd and embraces many time-saving features. A floating action of the slideways activates all the grasping tines. The smallest model has six tines, all other sizes eight tines. These tines, toughened by chrome vanadium steel, dig deeply like claws into a pile of scrap or other material, packing tightly and holding securely even when the grapple is tilted at a sharp angle. Grapples handle light or heavy scrap. *Ruhr Industries.*

**For more data circle No. 19 on postcard, p. 273.**

*Turn Page*

# *Industry's Widest Range*

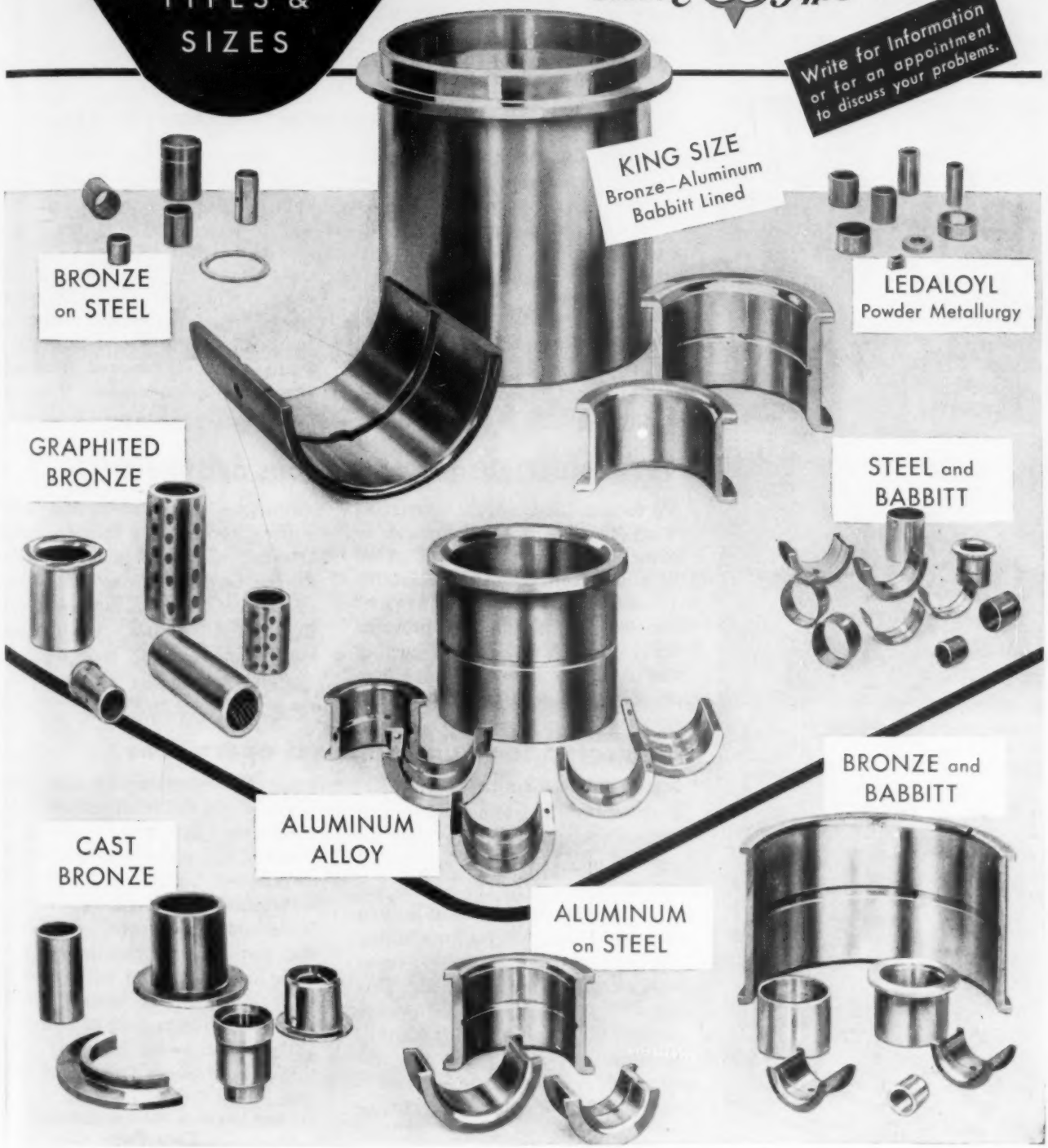
## •• OF SLEEVE BEARING TYPES & SIZES

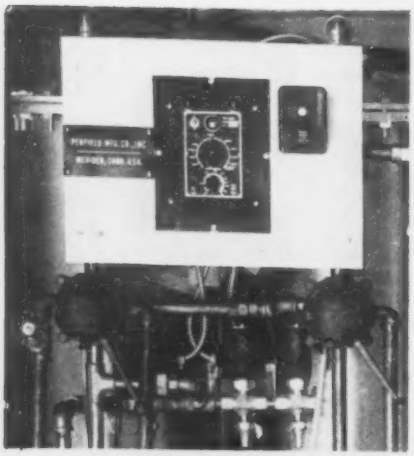
In this photo you will find a Johnson Sleeve Bearing of every type used in industry. Various alloys . . . bronze, babbitt or aluminum . . . can be selected . . . and different combinations with bronze or steel are available. Johnson Bronze facilities make possible a size range from tiny bearings up to King Size, 14" OD, 17 inches in length. Since Johnson Bronze produces all the types of sleeve bearings, their engineers can give you unbiased advice on the bearing best suited to your application.

JOHNSON BRONZE COMPANY
505 South Mill St. • New Castle, Pennsylvania

**JOHNSON B BEARINGS**
*Sleeve-Type*

Write for information or for an appointment to discuss your problems.





## Purity of storage tank water can be a certainty

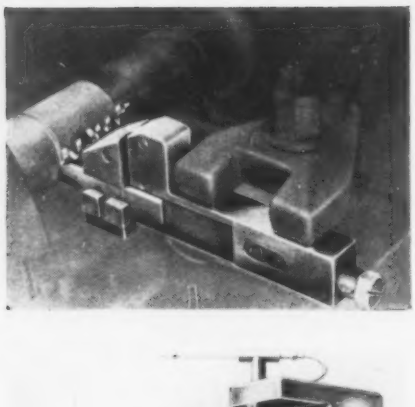
Special controls on a demineralizer enable the automatic maintenance of storage tank water supplies at a definite known purity standard. After the regeneration cycle has been completed and is in its final rinse stage, the operator switches on the unit's automatic controls which then perform all required functions completely automatically, including signaling when another regeneration cycle is needed. When storage tank level falls to a predetermined level, the demineralizer automatically starts another delivery cycle, allowing only water of the pre-set purity standard to reach the storage tank and automatically turning off when the storage tank has been refilled. All operations except regeneration can be accomplished without the presence of an attendant. Labor costs are cut to a minimum and purity of the water reaching the storage tank is an automatic certainty. *Penfield Mfg. Co., Inc.*

**For more data circle No. 20 on postcard, p. 273.**


## Roller type hold-back prevents conveyor reversal

Reversal of bucket elevators and inclined conveyors due to power failure under load can be prevented by a new enclosed roller type hold-back. It consists of an inner member with wedge pockets for six hardened rollers, that rotates with the shaft. When the shaft attempts to reverse, the rollers wedge against an outer cylinder. Pressure springs and plungers guarantee instant engagement of the rollers. The hold-back releases instantly when forward motion of the shaft is resumed. The device mounts directly on the drive shaft with the torque arm bolted to a support with sufficient strength to resist the load exerted when reversal occurs. Maximum torque resistance ranges up to 350,000 in.-lb for units with a 7 in. bore. *Standard Products Div. Stephens-Adamson Mfg. Co.*

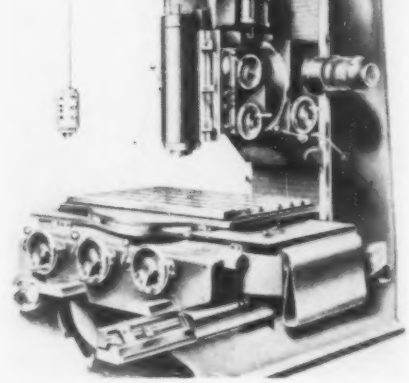
**For more data circle No. 21 on postcard, p. 273.**



## Tool holder absorbs vibrations and shocks

Vibrations and shocks occurring when turning rough surfaces or other than round work are absorbed by a new toolholder that maintains a constant cutting angle. Known as the Recoiler, the holder prevents breakage of bits, prolongs cutting tool life, and permits higher machine tool speeds. All shocks and vibrations are transmitted to a rubber spring pack located inside the shaft of the tool holder. Recoiler can be used for left or right hand operations and for cutting, parting and threading. High speed cobalt and carbide tool bits are available. *American Tooling Corp.*

**For more data circle No. 22 on postcard, p. 273.**



## One setup for many different operations

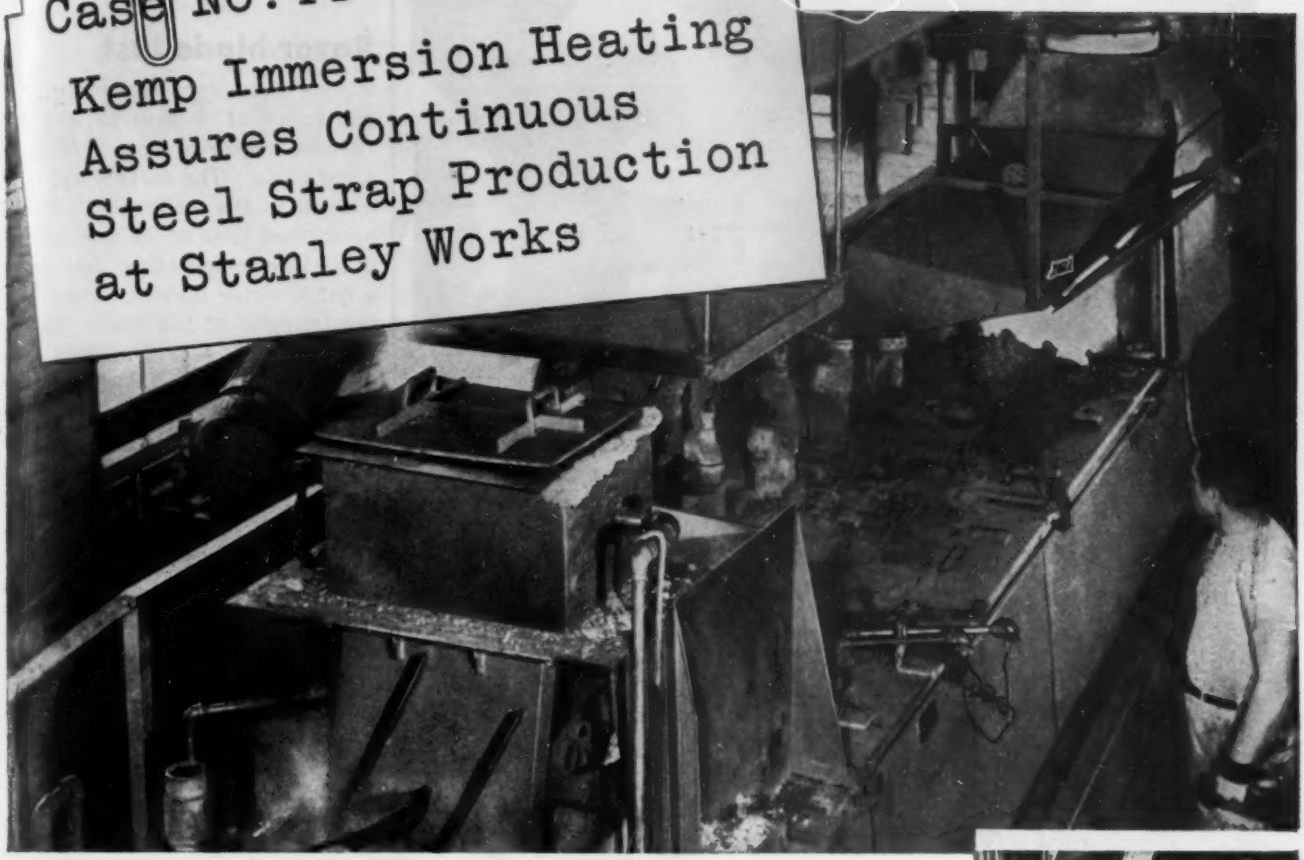
A swiveling column that turns 180° horizontally in either direction similar to a radial drill, is combined with an unusually large work table and deep throat in the new Bokoe No. 3 universal boring and milling machine designed for machining heavy cast iron and alloy steel workpieces to close tolerances. This massive 7½ ton machine handles workpieces as large as 8 ft 2 in. in diameter and provides a wide variety of movement which permits many different operations to be performed in one setup. Milling head on the column swivels vertically 90° in either direction; table feeds are infinitely variable in longitudinal, transverse and rotary directions. Large milling slide movements with six mechanical feeds and rapid travel allow drilling and boring operations up to 11⅞ in. and milling cutters up to 10 in. diam can be used. A wide range of settings and adjustments are provided, with infinitely variable spindle speeds from 36 to 1800 rpm. *Kurt Orban Co., Inc.*

**For more data circle No. 23 on postcard, p. 273.**

***Turn Page***

Case No. 44

# Kemp Immersion Heating Assures Continuous Steel Strap Production at Stanley Works



## How Stanley doubled steel strap capacity overnight . . . slashed fuel costs, too

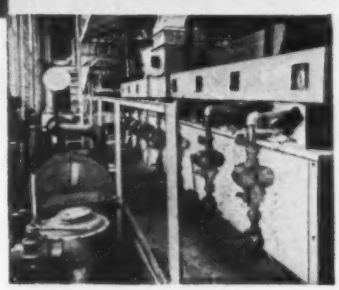
Today this bustling division of the famous Stanley Works at New Britain, Conn., turns out steel strapping on a 24 hour basis. Starting with raw, high carbon steel on giant spools, strap is semi-annealed, finished, coated and rewound again for shipping in one *continuous* process. New rolls of raw steel are simply spot-welded to the ends of rolls to eliminate any interruption.

### Kemp Eliminates Bottleneck

From an output limited by the capacity of a gas underfired pot, production was doubled on the installation of a 32 ton Kemp Immersion Melting Pot. In addition, Kemp's *greater* heating surface, *faster* heat recovery, *lower* dross formation and *accurate* temperature controls meant real savings in fuel costs. In the words of Mr. Harold Heckman, plant foreman, "Through quicker heating of this pot, we are able to maintain production schedules." And unlike underfired pots, Kemp units eliminate open flame hazards and excessive room temperatures.

### Let Kemp Help with Your Problems

If you're dissatisfied with your present heating or melting equipment, consult Kemp first before you make any changes. Let Kemp Engineers show you how they can solve your tempering, annealing, descaling or coating problems quickly and easily. Then just like the Stanley Works, you'll be *time* and *money* ahead.

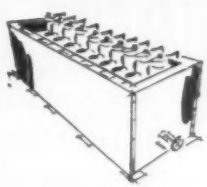


**Rear view of Kemp Pot at Stanley Works shows gas feed lines, fire checks, and the Kemp Carbureter (left). Part of every Kemp installation, this carbureter assures complete combustion . . . without waste . . . without tinkering. Just set it, and forget it.**

*For more complete facts, ask for Bulletin IE-11. Write:* **C. M. KEMP MFG. CO., 405 East Oliver Street, Baltimore 2, Md.**

**KEMP OF BALTIMORE**

**IMMERSION MELTING POTS**



**CARBURETORS • BURNERS • FIRE CHECKS**
**ATMOSPHERE & INERT GAS GENERATORS**
**ADSORPTIVE DRYERS • SINGEING EQUIPMENT**

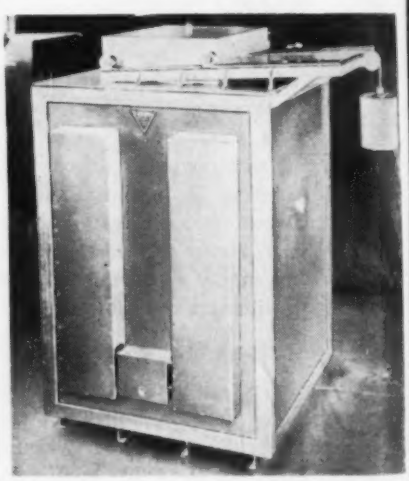
## Razor blade test

Simple test for determining the neutrality of a neutral salt bath furnace requires only a discarded razor blade. The razor blade is immersed in the molten bath for the prescribed time of 10 min or more at a given temperature, followed by a quick water quench. Because of the thinness of the blade, this test is extremely sensitive to an oxidizing bath. Partial or complete decarburization can be determined by the ductility of the quenched blade. If the blade bends, then carbon has been depleted, and the salt bath showing this evidence of a decarburizing tendency should be rectified immediately. If the blade snaps, the bath is neutral. *Ajax Electric Co., Inc.*

**For more data circle No. 24 on postcard, p. 273.**

## Top loading furnace

A new pit furnace, providing close control to 2500°F, is a top loading electric furnace with a firing chamber of 18,900 cu in. The chamber measures 18 in. wide x 25 in. deep x 42 in. high. The lid over the firing chamber is ball-



bearing mounted, side-sliding and counterbalanced for easy action, to permit loading from a hoist or conveyor. Fully insulated with 9-in. superduty, graded lightweight insulation of high thermal characteristics, the furnace may be equipped with any standard make temperature control required. *Pereny Equipment Co.*

**For more data circle No. 25 on postcard, p. 273.**
***Turn Page***

## Float your water-wash spray-booth troubles away with . . .

# NEW Wyandotte "FLOTE"


**A versatile, highly efficient *spray booth* product which eliminates tackiness and sinking paint sludge . . . prevents clogging and paint build-up in water-wash spray booths.**

**Slashes maintenance costs!**

**PREVENTS clogging and back-wall build-up!**

Whatever organic finishes you use, no matter what type water-wash spray booth you employ, new Wyandotte "FLOTE" will reduce your operating problems and cut maintenance costs.

New Wyandotte "FLOTE," floats even heavy primers and handles all paints at *low* concentrations.

### Read what "FLOTE" users* report:

"Excellent floating of heavy automotive primers . . . very easy to control."

"Better than two other well-known products for handling O.D. enamel."

"We get much less foam, a dependable, uniform water curtain, and reduced clean-out time!"

"Outstanding over-all results on white appliance enamel."

"Flote does a real job for us on furniture lacquers."

*Names available on request.

Another *NEW* Wyandotte product!

**"PHOS-IT"**

**for light soil and rust removal**

- Prepares metal for paint
- For wiping, brushing, immersion
- A concentrated liquid
- Low *use-cost*
- Meets JAN-C-490, Grade II, Type 5

**Wyandotte CHEMICALS**

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**Clip and mail the coupon today!** Let us tell you more about these two remarkable new Wyandotte products.

**Wyandotte Chemicals Corporation**
**Wyandotte, Michigan**

Please send further data on:

☐ "FLOTE" ☐ "PHOS-IT"

Name _____

Firm _____

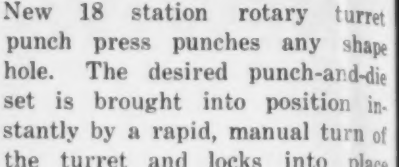
Address _____

City & Zone _____ State _____

## —New Equipment—
*Continued*

### Punches any shape hole

New 18 station rotary turret punch press punches any shape hole. The desired punch-and-die set is brought into position instantly by a rapid, manual turn of the turret and locks into place

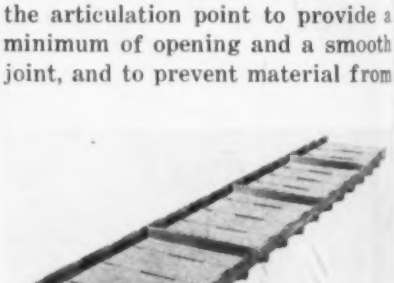


with perfect alignment. Punch-and-die sets can be made to designs or are available in scores of round or irregular shapes and sizes to 2 in. diam. *Rotex Punch Co., Inc.*

For more data circle No. 26 on postcard, p. 273.

### Apron conveyors

Piano-hinged apron conveyors in three pan types, four chain pitches and four basic assemblies, meet a wide variety of conveyor applications. The pans are interlocked at the articulation point to provide a minimum of opening and a smooth joint, and to prevent material from



seeping through. Tightness of the hinges reduces tendency to wedge or pinch materials being conveyed. Castings, stampings, scrap and chips are among the materials for which the conveyors are expressly suited. Pans measure 12 to 48 in. wide; are made in steel, stainless steel, aluminum and other materials. *Link-Belt Co.*

For more data circle No. 27 on postcard, p. 273.

*Turn to Page 287*

## —New Equipment—
*Continued*

### Radiant heater

Electric radiant heater for industrial oven heating is said to emit rays in the far-infra-red field. It can be used for baking, curing, drying, plasticizing and other heat processing where temperatures of 400° to 500°F are required. Heaters with ratings up to 1600° can be supplied. A single heating unit consists of a fused quartz tube, 48

in. long, in which is encased a heavy duty nickel-alloy heating element. The element is completely sealed and supported full length inside the body; cannot sag, warp or stretch. Each heating element has an individual stainless steel reflector. Radiant heater panels and assemblies are made up from multiples of these units. Capacities range from 100 to 1000 w per linear foot. *Cleveland Process Co.*

**For more data circle No. 28 on postcard, p. 273.**

### No-lap grinding belts

New Fisher no-lap grinding belts make possible the even application of finger pressure in grinding metallographic specimens prior to polishing. These belts have no overlapping portion in their surface; ends are cut at extreme angle and butted together. They can be slipped onto Fisher metallographic belt grinders in either direction. The grains cannot dislodge and belt life is claimed to be doubled. Variety of grades is available. *Fisher Scientific Co.*

**For more data circle No. 29 on postcard, p. 273.**

*Turn Page*

## Screwsticks

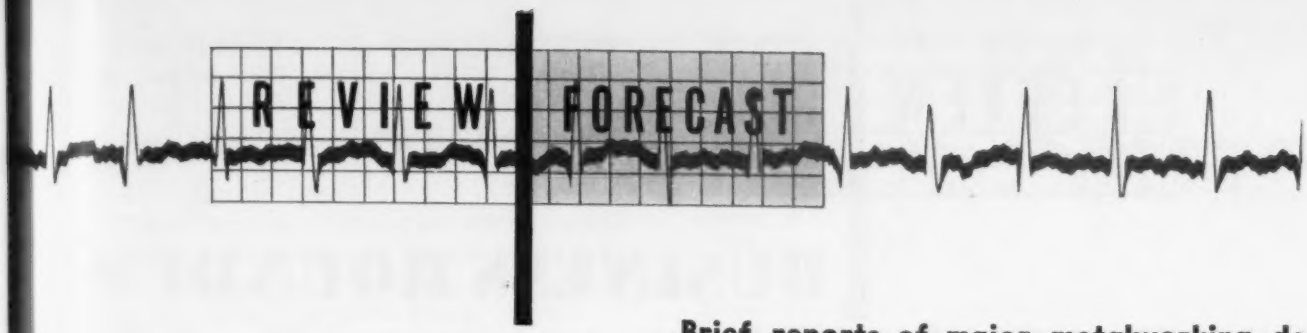
Screwstick is a one-piece stick of identical precision screws, each joined to its neighbor and used in pneumatic, electric, spiral or hand-ratchet drivers. It loads in a jiffy and the entire stick feeds automatically. It combines simplicity and speed of fastening with rivet-like strength; insures alignment between screw and threaded hole. And constant measured torque provides uniform tightening always; eliminates any need for special skill in driving. The drive stops automatically when holes don't measure up. Screwsticks are available in diameters of Nos. 0, 1, 2, 3 and 4 in mild steel, brass and aluminum. *American Screw Co.*

For more data circle No. 30 on postcard, p. 273.

## Air conditioning

For storage warehouses and war production plants in stand-by condition a new adaptation of the Kathabar humidity conditioning equipment has been designed. The units represent an effective combination of refrigeration and chemical dehumidification. An air-cooled compressor is used. The condensing coil is located in the leaving air stream, giving the system adiabatic operation. Units are compact; work entirely on electric energy. They do not require the heating of the building in order to maintain 35 pct relative humidity, even to as low as 20°F temperature. *Surface Combustion Corp.*

For more data circle No. 31 on postcard, p. 273.




**Brief reports of major metalworking developments of 1953 together with business and production trends to watch this year.**

REVIEW | FORECAST

# BUSINESS ROUNDUP

**Weather glass high for business in '54 . . . Civilian consumer dominates market. Any decline will be gradual . . . Materials, prices are softening.**

The Great Transition is proving to be the most profitable economic revolution on record. The much-heralded switch from a defense-centered economy to one built around the civilian consumer is setting production and earnings records throughout American industry. For business, 1953 was one of the alltime great years; 1954 will be almost as good.

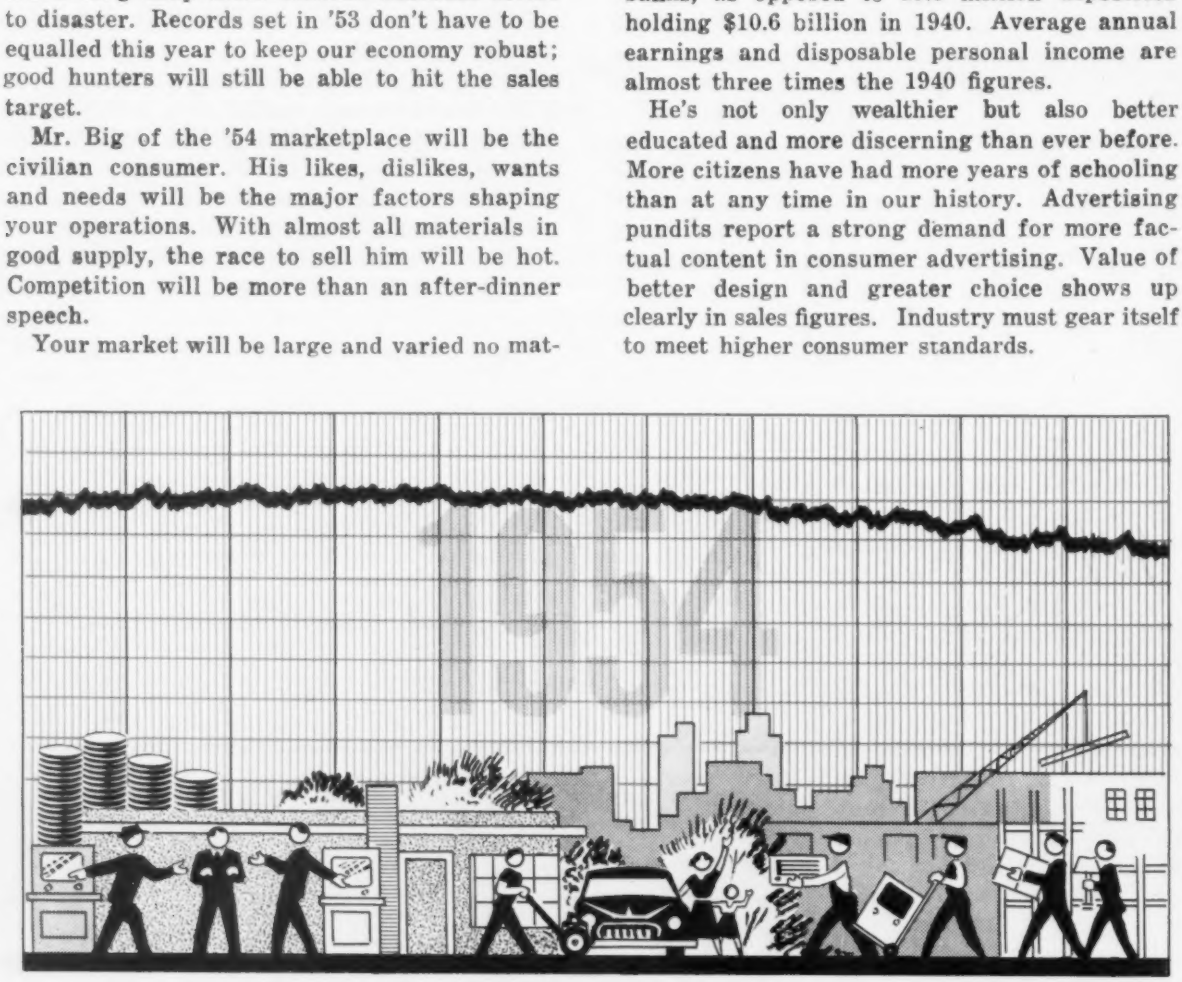
Don't be misled by the professional pessimists: some wailing wall regulars hear the crack of doom every time a sensitive business indicator flickers momentarily downward. But it's a long drop from current business levels to disaster. Records set in '53 don't have to be equalled this year to keep our economy robust; good hunters will still be able to hit the sales target.

Mr. Big of the '54 marketplace will be the civilian consumer. His likes, dislikes, wants and needs will be the major factors shaping your operations. With almost all materials in good supply, the race to sell him will be hot. Competition will be more than an after-dinner speech.

Your market will be large and varied no matter whom you sell—individual consumer, industry, or government. U. S. population is now well over 151 million, should hit between 198 and 221 million by 1975, Census Bureau estimates. The President's Materials Policy Commission assumed for its report that the gross national product of 1975 would be double that of 1950. A recent Brookings Institution study calls that assumption "conservative."

The consumer is wealthier than ever before. Over 20 million depositors now have well over $23 billion stashed away in mutual savings banks, as opposed to 15.8 million depositors holding $10.6 billion in 1940. Average annual earnings and disposable personal income are almost three times the 1940 figures.

He's not only wealthier but also better educated and more discerning than ever before. More citizens have had more years of schooling than at any time in our history. Advertising pundits report a strong demand for more factual content in consumer advertising. Value of better design and greater choice shows up clearly in sales figures. Industry must gear itself to meet higher consumer standards.



From 57 to 59 pct of America's 43-million-odd families own their own homes—$250 billion worth. Since only $50 billion is owed on existing dwellings, market for both new and replacement housing is likely to stay strong for some time to come.

Homebuilding is a boon to metalworkers with its accompanying demand for consumer durables. Much-mentioned trend to single-family suburban homes only strengthens this demand, extends it to such diversified items as automobiles and lawn mowers. And the prosperity it implies means continued high sales of semi-luxuries like air conditioners, television sets, washing machines.

Public and municipal construction will be a major market. Delayed first by World War II and then by Korea, much of this work is long overdue. American Assn. of State Highway Officials estimates that a 15-year program for adequate roads and streets would cost about $6 billion annually. Educational authorities state we will need over $14.5 billion worth of new school construction and equipment by 1960.

Surprise of the year will probably turn out to be capital goods spending. There was a strong feeling for some time that this year would be far below 1953's record $28 billion for expansion and modernization. Indications now are that capital goods sales this year will be surpassed only by last year's alltime high.

### Capital goods market stays big

Preliminary surveys show that all business plans to spend slightly less for new plant and equipment in '54 than it did in '53. SEC predicts that outlays for new plants and equipment in the first quarter of this year will be only about 1 pct below the 1953 level. Manufacturing industries generally will spend at about 6 to 8 pct under last year, with heavy industry like steel, aluminum, accounting for most of the dip. Consumer durable industries have ambitious expansion plans for this year.

Transportation industries will be down about 10 pct, mainly because of completion of railroad dieselization. But utilities expansion will be virtually unchanged, and commercial trades and services are planning capital spending above '53.

It's interesting to note that most of this new expansion is planned without government aid. Tax-aided projects were two-thirds complete by the end of '53, but industry apparently feels the need for further growth. One indication is the finding of a recent American Society of Tool Engineers survey that industry considers 28 pct of its production equipment obsolete.

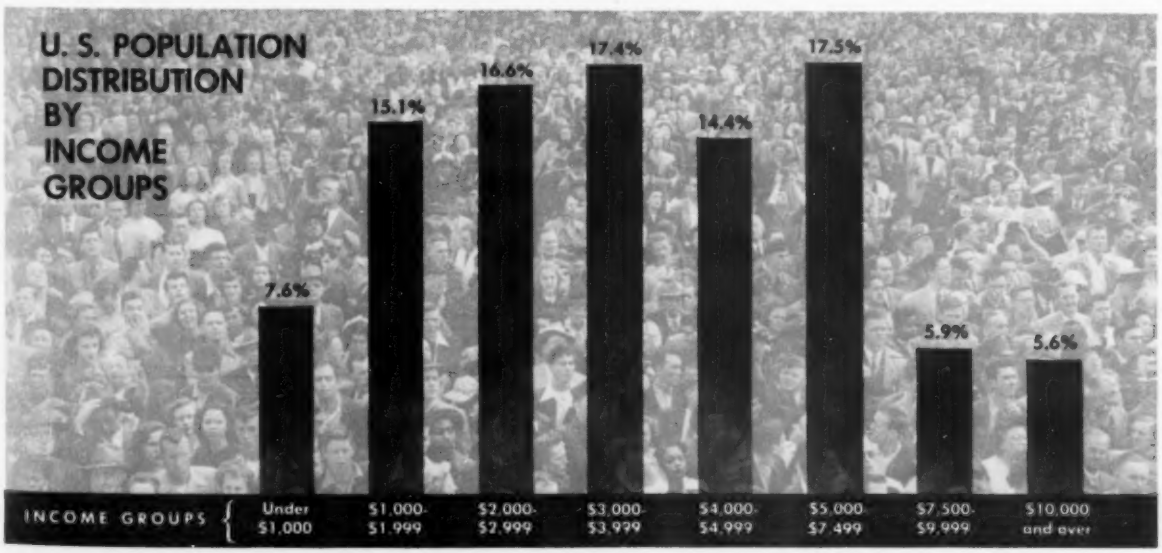
### Defense spending will dip slowly

Defense spending this year will come in like a lion, continue throughout the year with only slightly diminished vigor. While there is considerable agreement that the fiscal '55 defense budget, which takes effect July 1, will be about $38 billion, or $5 billion under fiscal '54, the inevitable downtrend will not be apparent for some time thereafter.

Big reason is the time lag between placing of defense orders and actual payment for war material, which usually doesn't come until delivery. On aircraft this lag can be as long as 4 years. And, if Pentagon thinking continues along present lines, aircraft and related items such as guided missiles will come in for continuing larger shares of the defense dollar.

Present plans call for pulling annual defense outlays down to the $32 billion mark by 1957. This means a reduction of $10 billion from the peacetime high of $42 billion in the hands of the Army, Navy, and Air Force during the present fiscal year.

"More defense for less money," the slogan of the new Pentagon team headed by Charles Wilson and Roger Kyes, is beginning to take hold in military procurement circles. Mr. Kyes' philosophy: The U. S. can no longer afford to pre-



pare for every conceivable kind of war. But defense spending must remain at a relatively high point for a long time. See to it that the taxpayer gets his money's worth for every dollar spent on defense contracts.

Moderate cuts in the defense budget, both in appropriations and in actual spending, are in the cards—not enough to make budget-balancers happy but too much to please those who fear for national security. Key point is that budget figures for the Pentagon which go to Congress within the next few days can be regarded as probably representing the defense price tag for not only next year but perhaps the next half-decade.

Actual spending can be figured at several billions higher each year as the more than $50 billion backlog is worked off. Present defense plan calls for moderately stepped-up emphasis on atomic artillery and other new weapons and a 137-wing Air Force.

Air timetable calls for 115 wings by June next (1 more than earlier expected), 120 by June 1955, and 127 by mid-1956. Between 3.1 and 3.2 million personnel will be required to support the plan. Annual bill at current cost levels won't run less than $30 billion, probably a little higher.

### Steel prospects still good

Steel is a bellwether industry, often used to evaluate the general business future. And steel has already emerged from its primary "correction" cycle with operations still at a good level. Moreover, outlook for the future is scarcely tarnished.

Consumers will probably call on the industry to produce about 100 million tons of steel in 1954. This would be the third highest production in history, surpassed only by the alltime record 112 million tons poured in 1953 and the previous record 105 million tons in 1951.

Production of 100 million tons this year would represent a decline of about 10.7 pct. But it would not indicate a decline of that much in consumption because during the first half of 1953 much of production was going into inventory pipelines.

Demand should be strong during the first half of the year because: (1) New models and seasonally strong spring selling will give manufacturers early foot in the race to move their stocks, and (2) there will be some strike-hedge buying just in case new steel labor contracts can not be peacefully negotiated before termination June 30.

### Price concessions will come

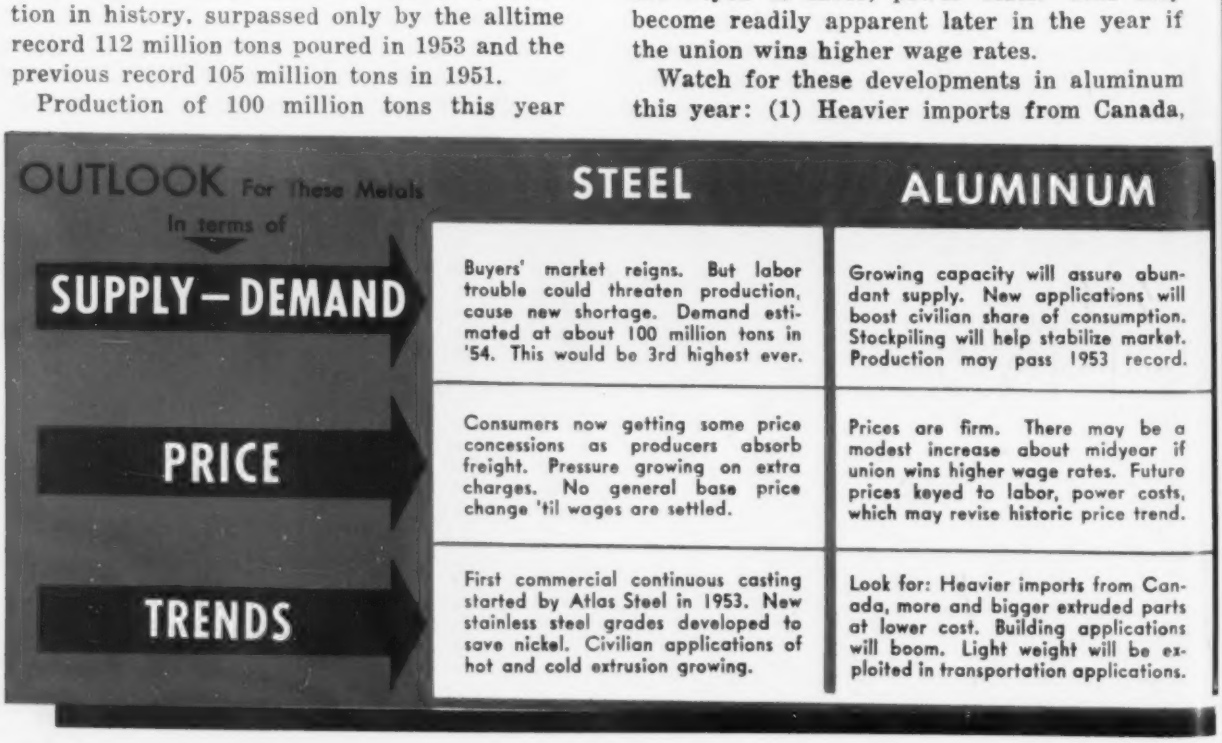
If new wage contracts can be successfully negotiated, there will likely be a seasonal slump in demand during the hot months, followed by another pickup in the fall.

Consumers will hammer out more price concessions: Freight absorption will be increased, and more pressure will be brought to bear on extra charges. High cost producers will of course have to meet competitive levels. But it is unlikely that there will be any general base price change until the wage question is settled about midyear.

Aluminum producers and fabricators are heading into another good year. Growing capacity will assure abundant supply. New applications will boost the civilian share of consumption. And stockpiling will help stabilize the market. Production may pass the 1953 record of 1.25 million tons.

Barring cost-saving changes in production methods, aluminum producers have just about exhausted possibilities of lowering prices as they expand output. Future aluminum prices are keyed to labor, power costs. This may become readily apparent later in the year if the union wins higher wage rates.

Watch for these developments in aluminum this year: (1) Heavier imports from Canada,



(2) more and bigger extruded parts at lower cost, (3) a boom in building applications, especially curtain walls, and (4) continuing drive to exploit its light weight in transportation application.

The copper shortage has been whipped. Chilean supplies will ease the artificial tightness of late 1953. The industry will win back some applications temporarily lost to substitute materials during the shortage. And consumption in 1954 will be close to the 1953 level.

Copper prices will drop to about 25¢ per lb by midyear. Brass mill products, secondary ingot, and scrap will be lowered accordingly.

Nickel will be the only major metal remaining scarce. Government procurement contracts should promise steady improvement, but it will be many months before supply and demand are again in balance. Development of substitute alloys will continue.

Although regular nickel prices are firm, consumers will continue to rely on expensive conversion and overseas nickel to augment scarce supplies. Barring change in mining methods or technology, longterm price trend is up. Heavy consumption is forcing mining operations deeper underground.

### Hope to boost combined price

Lead and zinc producers will make a determined bid to revive these depressed markets. Total supply (especially of zinc) will be restricted to hold stocks in check. Primary producers will strive to boost combined price to 30¢. Federal import tariffs on metal will be a hot issue this year, and question of mine subsidies will again be raised.

Outlook is that more marginal facilities will be shut down, but that high auto production will again help shore up lead battery and zinc diecasting markets.

Expiration of excess profits tax will mean a profit windfall for many firms—even at moderately lower business level. But this windfall will be shortlived—if EPT is replaced with some other form of tax, as many people in industry and government expect.

There is more than a mild threat of labor trouble this year. Unions will be striving for an eighth-round wage increase, and once again United Steelworkers will be in the vanguard of the wage drive.

They have already made clear what they want: (1) Increase in pensions from $100 to $150 per month, (2) broader social insurance benefits paid for entirely by management, (3) higher wages, and (4) some form of guaranteed annual wage.

Chances are the union will again trade the GAW for other concessions, despite protestations to the contrary. But concessions will come hard in a year when cost cutting and competition are getting top billing from people in industry.

### What will labor win?

Whatever gains the steelworkers are able to win will quickly become a basis for bargaining with other unions who will not be inclined to settle for less than the steelworkers get. This will prove especially galling to many small manufacturers who will be expected to at least match the pattern setting agreement—no matter how much it hurts.

Spurred by competition, manufacturers will have greater incentive than ever to increase productivity—by every means possible. This will be the strongest selling point of tool and industrial equipment makers in 1954. For that matter it has always been the most accurate measure of industrial strength.

| COPPER | NICKEL | LEAD & ZINC |
|---|---|---|
| Shortage has been whipped. Chilean supplies will ease artificial tightness of late 1953. Consumption in '54 will be close to '53 level. Stockpiled Chilean surplus won't upset market. | Nickel will be only major metal still scarce. Supply will not catch up with demand for many months, although it will improve gradually. Major interest will center on procurement. | Total supply (especially of zinc) will be reduced closer to demand level in order to lower stocks. Import tariffs will be a political hot potato during next year. |
| Prices will drop to about 25¢ per lb by midyear. Brass mill prices will be reduced accordingly. Prices of copper scrap and secondary ingot will also be lowered before many months. | Regular prices are firm. Consumers will continue to rely on expensive conversion, overseas nickel to augment scarce supply. But no increases in regular prices are expected. | Primary producers will strive to boost combined price to 30¢. But weak market bars any sharp increases. Lead will be more stable than zinc during '54, but both lack strength. |
| Copper industry will win back some applications lost to substitute materials during recent shortage. Continuing growth of electric facilities and high auto output help market. | Barring change in mining methods or technology, long term price trend is up. Heavy consumption is forcing mining operations deeper underground. Substitute alloys will continue. | More marginal facilities will be shut down. But high auto production will again help lead battery, zinc diecasting markets. Future depends on Federal metals tariff policy. |

REVIEW | FORECAST

# METALS & MATERIALS

**Iron ore shippers set record . . . Coal, refractories industries optimistic . . . Scrap market dips . . . Alloy users shift requirements . . .**

IRON Ore shippers left a string of records in their wake during 1953. When the season got under way in early April a 100,000,000 ton goal was everybody's objective. Spurred on by really tremendous steel production, the 286 vessel fleet barely missed the mark.

As the ore fleet moved into winter storage in early December, Lake Superior Iron Ore Association reported annual haul totaled 95,844,472 tons. Previous record, 92,076,781 tons was set in 1942. At least 105 million tons could have been added but the ore just wasn't needed.

Weather was so favorable and newer vessels did such an outstanding job that lakeside storage bins were crammed by late summer. At that time larger steel firms had more than enough ore. Smaller independents just could not find space for more raw material.[1]

Statistics on stockpiling and total consumption tell the story more adequately than words. By January 1, 1954 mills had managed to stockpile an estimated 45 million tons. Last year on New Year's Day stockpiles held 45,171,000 tons.

An ambitious ship building program which started in 1950 had a lot to do with the record performance. In the 3 year span 22 modern vessels hit the water for the first time. Six of these went into service last year. Most of these 20,000 ton giants are able to make a complete trip to lakehead and back in 5 days.

Lake men looking ahead to next April hesitate to be definite about how much red gold the nation's blast furnaces will need in '54. If steel making operations dip to 85% or lower 80,000,000 tons will be enough. But if mill production stays between 90% and 95% shippers feel a 90,000,000 ton goal would be right.

Speculation concerning dwindling supplies of open pit ore in the Mesabi Range is keeping low grade ore very much in the limelight. Beneficiation of Taconite and Jasper is now being pushed harder than ever.[2] Some 7 major steel companies are committed to spend between $700 and $800 million to "manufacture" over 20 million tons of Taconite pellets by 1960. Production in 1954 should reach 1,500,000 tons[3].

In addition to this tonnage the Humboldt Mine, jointly operated by Ford Motor Co. and Cleveland Cliffs Iron Co., should be processing close to 400,000 tons of Jasper this year.

Coming year should also see introduction of high grade open pit ore from the far north. Quebec-Labrador's $225 million project is scheduled to produce 2,500,000 tons of 57 to 60% Fe ore this year. This total is expected to jump to 10 million tons by 1956.[4]

Canada's Steep Rock Mines should also prove a rich source. An estimated 1,500,000 tons were mined in the new Hogarth open pit in 1953 and promoters estimate Steep Rock range will eventually produce 9,500,000 tons of high grade ore annually.

Future for South American ores is bright. Some authorities estimate that from one-third to one-half of foreign ores imported by U. S. in the future will come from Venezuela and other South American countries.

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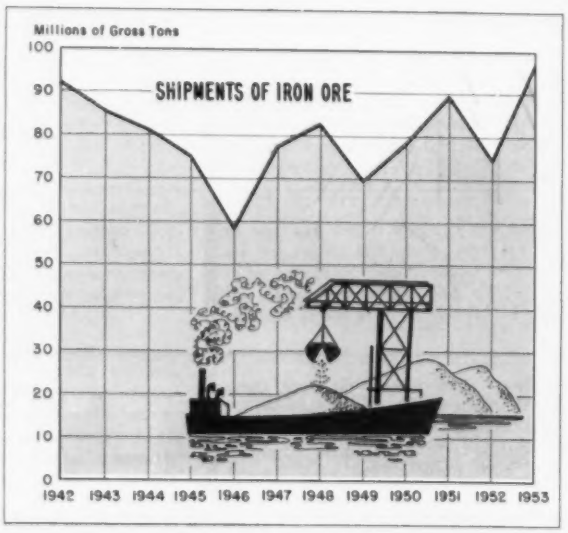


# COAL

## Industry forecasts upturn in future . . . Mechanization is major competitive factor.

High purity foreign iron ores and beneficiated taconites, while eagerly sought by steel producers, are not entirely an unmixed blessing. The very purity of these ores creates problems that have prompted steel producers to redouble their efforts to locate additional sources of low sulfur coal for coking purposes.

Lack of fluxing materials in the purer ores means that removal of sulfur in the blast furnace is that much more difficult. To overcome this, the mills are adding gravel and limestone to the blast furnace charge. This, of course, tends to reduce the yield of the furnace. Steel producers also are investigating methods of desulfurizing coke and hot metal.

### Low sulfur sources decline

Sources of low sulfur coals have been gradually declining, particularly in Pennsylvania. Large deposits in Southern West Virginia usually are shipped into the Chicago area. Pennsylvania steel producers, if they are to tap this source for their mills, are faced with high freight costs to get the coal to their ovens. Realizing this, they are intensifying the search for additional beds closer to the mills.

Another development of particular interest to steel companies is research into the possibility of substituting char for low-volatile coal, where economically feasible. If investigations now being conducted are successful, high-volatile coal would be put through the charring process and the resulting char would be used for coking purposes.

### Seek answer to stream pollution

A headline-grabber during the year was a study sponsored by Bituminous Coal Research and 14 electric utility companies on the merits of electric furnaces versus openhearths in production of low carbon steels. The research report by Battelle Memorial Institute, while not conclusive, was encouraging to the coal industry and the utilities. As an example of how the coal industry would benefit is the estimate that one of the larger electric furnaces will use power in one year equivalent to the generating capacity of 60,000 to 80,000 tons of coal.

A great deal of research has been done toward solving the problem of stream pollution by coal mines. But the industry still has not come up with a practical answer to the nuisance of acid mine drainage. Search for a solution to the stream pollution problem wil be intensified during the coming year.

The coal market during the year was nothing to cheer about. Production and shipments were down from 1952 due to further inroads of gas and oil into former robust markets, plus the virtual disappearance of foreign demand. Price cutting appeared in some areas. Coal miners worked as little as two days in some weeks. The marginal companies began closing shop, and the larger producers tightened their belts.

### Industry outlook optimistic

Despite this, the industry is optimistic over the long haul. It believes the shakedown period has just about run its course, and some look for a gradual upturn between now and 1960. This optimism is based partly on the outlook for further expansion of electric generating capacity, partly on research and studies toward development of new markets. The industry also feels that eventually reserves of natural gas and oil will decline to the point where coal will become more of a factor in fields where it has lost out to these competing fuels.

### Strip mining shows gain

The year saw further strides in mechanization of coal mines, and one steel producer has a completely mechanized mine and is fast converting others. Mechanization is a major competitive factor, particularly in today's tight market. Strip mining made more gains at the expense of deep mining, and it is estimated that approximately 40 pct of coal production is through stripping operations. Even some metallurgical coal is mined in this way.

GOOD EXAMPLE of modern strip mining methods is this 50 cu yd shovel operated by Hanna Coal Co., near Cadiz, Ohio.

# SCRAP

## Scrap purchases miss record despite high steel output . . . Some decline seen in 1954 . . .

Consumption of purchased iron and steel scrap in 1953 failed to squeak through to a record despite an all-time high in output of steel. Estimated at 32 million gross tons, scrap steel consumption was somewhat depressed by abundance of pig iron and iron ore and could not quite attain the record level of 33.8 million tons set in 1951.

Paradoxically, 1953 saw 112 million net tons of steel produced against 105 million tons in 1951. Toppling records, pig iron use climbed to about 67 million gross tons against 63.8 million tons in '51 and home scrap use rose to about 36.5 million against 34.7 million in 1951.

For strike-affected 1952, 30.5 million tons of purchased scrap and 31.1 million tons of home scrap went into furnaces against only 43.3 million tons of pig iron. This year, pig iron regained its position.

Last year scrap was plentiful and the scrap industry was geared for huge scrap collection. Consumer scrap and pig iron stocks were considered mountainous.

### Some marginal sources dried up

In certain segments of the scrap industry some frustration resulted later in the year from inability to get all the orders its expanded, more fully mechanized preparation plant could handle. Many marginal sources of scrap, coaxed into shortage existence, were allowed to wither. In outlying areas, some scrap yards were hurt by declining prices and sometimes by shrinking order levels.

Entering 1953 with stocks of purchased scrap totaling almost 5 million tons, consumers began to adapt themselves to a new buying climate. Their stockpiles had reared upward because of heavy buying after the 1952 steel strike. Yet through the year, fluctuation of purchased scrap stocks was piddling. As of September '53, purchased stocks were 4.8 million tons.

Early in '53 first market softening afflicted such secondary grades of scrap as No. 2 bundles and turnings. Mill inspection of scrap became sharp-sighted. When Office of Price Stabilization controls ended in February, price structure of the market began to assume former differentials between grades.

THE IRON AGE's No. 1 Steel Scrap Composite rose from February's $42.92 to $44.18 in March, reflecting the eagerness with which consumers sought quality grades. April showed the price hike was temporary when THE IRON AGE composite dropped to $41.75 and secondary grades weakened further.

For the first half of the year the market continued soft—but in July a flurry of optimism sent the price composite to $44.60 from $40.97 in June. But this resurgence was shortlived because the No. 1 composite declined shearly to $32.67 in October, rallied up to $35.21 in November and slipped once again about $30. Heavy mill stocks of scrap, pig iron, ore, abundance of scrap, a slightly declining steel ingot rate combined to drastically shake down scrap's price structure.

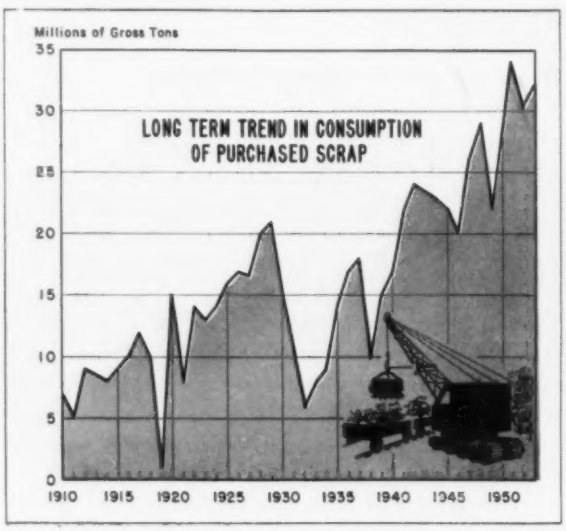
How will the scrap industry perform in 1954? Probably not as well as in 1953. With market factors remaining essentially unchanged and steel operations estimated at millions of tons less than 1953, scrap consumption was seen as declining.

End of government price controls early in 1953 gave a quick jolt to nonferrous metal scrap prices, loosening up tight supplies—especially in aluminum, brass and copper. Zinc and lead were in good supply and sold well below ceiling levels.

Copper and copper alloys hit price peaks early in the spring, declined a bit, fluctuated mildly. Prices were fairly strong in the fall as a result of overseas demand but the imminent release of Chilean copper supplies served as a damper to runaway conditions.

Aluminum scrap reached its first high in midsummer with a dealer price level of about 10¢ per lb. It then declined moderately with the general easing in aluminum but bounced back to the 10¢ level in late fall with foreign demand bolstering the market.

Zinc and lead, low at the beginning of the year, sank to even lower levels in the wake of their primary metals.



# REFRACTORIES

## Explore use af carbon linings in blast furnaces . . . Use of plastics, castables rising.

Interest in use of carbon linings in blast furnaces was spurred during 1953 by an installation at the Gary Works of U. S. Steel Corp.

Following a thorough study of the experiences of steel producers in this country and abroad with such linings, U. S. Steel lined its Gary No. 10 furnace from bottom of the stove coolers to 35 ft above the mantle.

In a report before the General Meeting of American Iron & Steel Institute last May, J. M. Stapleton and W. S. Debenham stated:

"In taking this very large step in the use of carbon, we feel we have reason to be confident of the outcome of the lining below the mantle. Should this prove true, then the benefits thus to be derived from increased furnace capacity, smoother operation, and the elimination of both cooling plates, could outweigh higher initial refractory cost.

"In the use of carbon in the stack lining, we admittedly are on uncertain ground, but it is an area worthy of exploration, due to potential advantages." Steel industry sources say there are indications of growing use of carbon linings in blast furnaces, both numerically and in extent of its application in the furnace.

### Study fire clay brick terms

In another direction, the steel industry and refractories producers are continuing studies aimed at reclassifying fire clay brick and adopting more accurate terminology in describing qualities of the brick. Three committees are working on the problem, including the Refractories Institute and the Refractories Committee of ASTM.

The situation with regard to super duty clay brick for blast furnace linings finds some companies completely sold, other uncertain and cautious. There is still considerable interest in hard burning Cone 23 brick, with some producers using it heavily while others are willing to await results of present installations. There is some concern over spalling with this type of brick.

The use of plastics and castables in soaking pits and reheating furnaces continues to grow. Castables are gaining more widespread acceptance than the plastics.

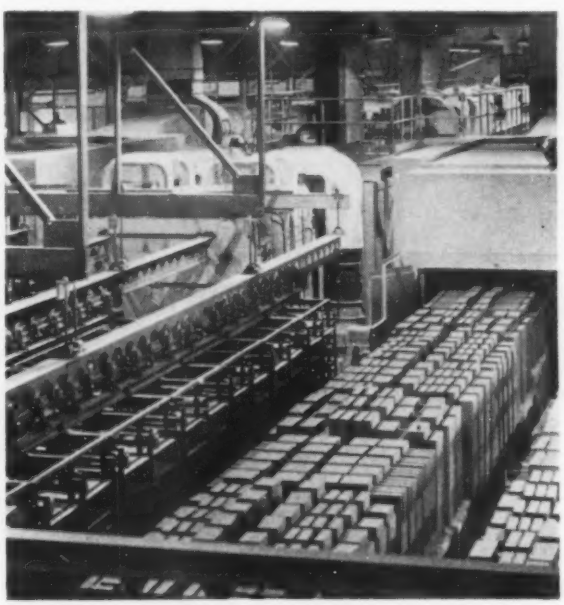
Improvements in the quality of silica brick is noted by steel producers. Several refractories companies have opened new silica plants for the production of higher purity materials. A higher proportion of super duty silica brick is being made.

The question of the zebra roof is still far from resolved. Uncertain frame of mind of openhearth operators is indicated by the fact that some have gone back to the zebra roof after once giving up on it. Others are backing away. In some shops there appears to be a tendency to extend its use in the furnace. Estimates are that more than 100 openhearth furnaces are using the zebra roof.

The steel industry is continuing its experiments on the possibility of replacing plastic chrome door linings with castable basic linings.

Despite the gradual decline in steel ingot operations during the last quarter of 1953, the refractories industry expected to wind up the year with a good production and shipment record although no one looked for anything like the record set in 1951. Other markets also held up well for refractories producers during the year, including glass, ceramic, oil, chemical, and cement.

Generally, the industry is optimistic about market prospects next year, although few of them expect customers to be on the offensive as they have in recent lush periods. The industry is in better shape from an efficiency standpoint due to new construction employing latest methods in automation. Some of the newer plants approach the ultimate in automatic operation. Within the last six years, the industry has expanded between 35 to 40 pct.



UNBURNED BRICK entering kiln car dryer, foreground. At left monorail tracks at entrance end of rack car dryer. Scene at Windham, Ohio plant of Harbison-Walker Refractories Co.

# METALS AND ALLOYS

## Decontrol of alloys shifts users specs . . . Expand titanium output . . . Big increase in iron powder capacity . . .

The field of alloys and alloying agents was undergoing a transitional period as 1953 came to a close. Efforts to find substitutes for critically short alloying materials relaxed somewhat as the slackening of government controls on materials and a tapering off of demand increased supplies to both ferrous and nonferrous users.

Much was learned in the way of substitution and conservation during 1953. New alloys were developed to meet current needs and availability of alloying materials. Now as the supply outlook brightens these efforts are being re-evaluated. Freeing of molybdenum controls at midyear brought quick revisions of some alloy steel specifications by automakers.[1] Those favoring straight moly steels hastened to abandon temporarily triple alloy specifications and return to former specs.

Almost every auto company will retain some substitutes. Triple alloy steels were found to work successfully for some parts where they had not been used before. Certain gears and axle shafts are examples. Others found straight chrome steels suitable for springs, knuckles and other parts. In some cases substitutes effected cost savings, while increases in alloy extras discouraged a return to former alloy steel specifications.

Decontrol of nickel restrictions for all but military and atomic energy uses Nov. 1 caused a greater shifting of alloy specifications and intensified an already terrific market demand for nickel.[2] Platers are driving hard to recover automotive and other applications where straight chrome stainless and other materials had been substituted.

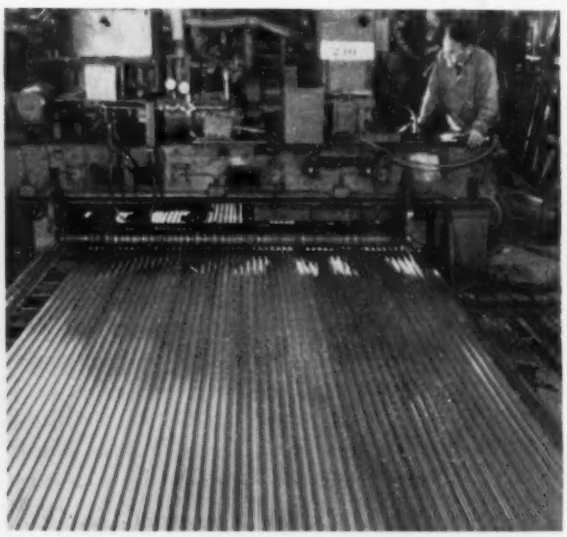
Stainless steel producers were given a shot in the arm by the lifting of nickel restrictions which they claim had aggravated a slow market for stainless. Another factor was the slowing effect resulting from speculation prior to decontrol. Consumers using substitute grades withheld orders and reduced inventories in anticipation of a free alloy market.

Even with controls ended nickel will remain short for some time and users will have to retain some substitute grades. Reasons for this include: (1) Overstating of actual requirements by some users, (2) government will continue to add nickel in the defense stockpile, (3) mills may not receive as much nickel for steelmaking as they did under allocations, even though more nickel will be available this year than last (estimated 20 million lb more).

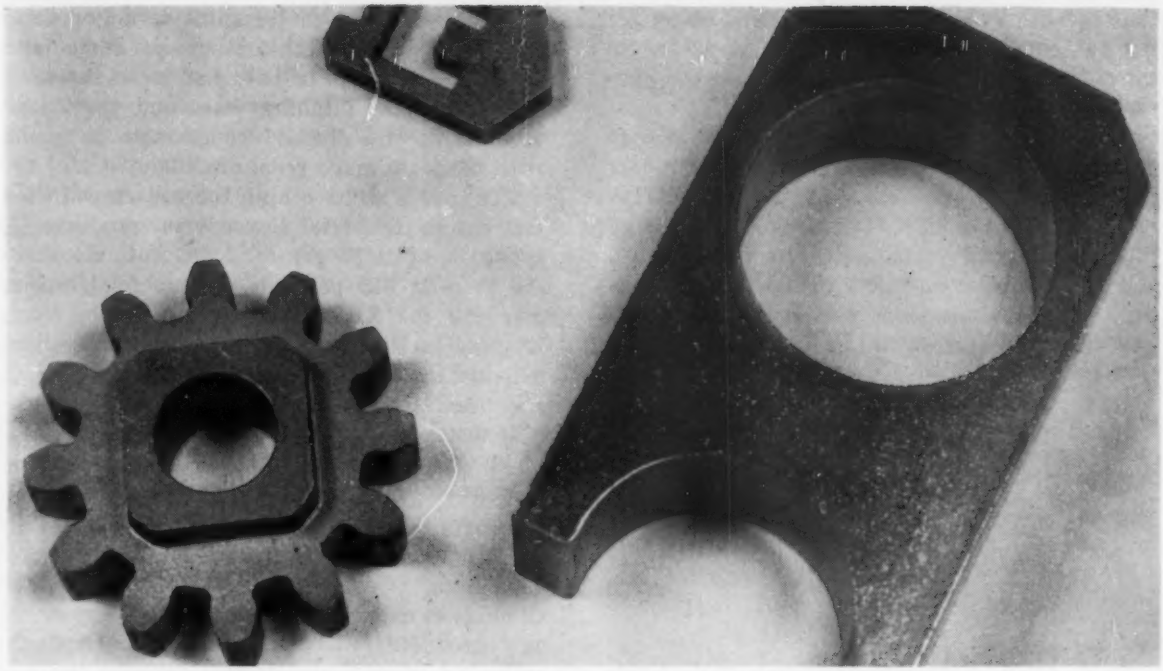
An 18-8 stainless alloy containing copper, molybdenum, silicon and small amounts of beryllium was developed during 1953 for use where high-corrosion resistance, good machinability and erosion resistance are needed. Called V2B, the steel's nongalling characteristics have suggested its use for valve discs, pump impeller gears and other wearing parts.[2]

Another stainless alloy developed as a substitute for type 301 stainless has an analysis of 16 Mn, 16 Cr, 1 Ni. Manganese, like nickel, has the property of producing an austenitic struc-

CONTINUOUS, submerged arc furnaces melt ore and other materials at new Marietta, O. plant of Electro Metallurgical Co.



SEAM WELDING a TRC steel trailer side at Budd Co. Six corrugated sheets and edge are seam welded simultaneously.



**STEEL OILITE parts. This ferrous base material is reported to be the first powdered metal composition with ductility—as well as strength—in the range of low carbon steel.**

ture, though it takes about twice as much to do it. Called TRC by The Budd Co., its high physical strength is of great advantage in structural parts for tramways and railway cars. Budd fabricates TRC with no changes in methods or tooling from those used for type 301 stainless.[4]

Elsewhere, re-examination of service conditions in some cases permitted use of straight chrome grades. In mild corrosion applications 430 was used and where conditions were severe, type 442 was found to be a good substitute.[5] Relaxing of columbium controls is expected to bring this alloy back more strongly.

Boron steels declined in favor among some users in 1953. Price was one of the reasons particularly among automotive manufacturers. Tractor manufacturers are still strong for some boron grades because of their ability to meet the rugged service conditions required in certain tractor parts.

Producers of ferroalloys continued expanding last year to keep pace with the steel industry's growth. Electro Metallurgical Div.'s new plant at Marietta, Ohio, greatly increased this Union Carbon and Carbide subsidiary's ferroalloy capacity. A new process in use at the plant produces ferrochrome with carbon content as low as 0.01 pct. Other major plant features include a new electrolytic method for producing tonnage quantities of chrome in practically pure form and a new electrolytic processing setup capable of turning out several thousand tons of pure manganese yearly.

Ground was broken in the early part of the year for the construction of a plant to recover manganese from slag on a commercial basis. Using the Bureau of Mines process the new plant at Coxton, Pa., is expected to produce 1000 tons of ferromanganese per month when in production.

Use of rare earth oxides and metals increased in 1953. Rare earth oxides, some claim, can improve the hot workability of stainless such as 308, 310 and 316 grades. No improvement, however, is noted in the inherently hot short grade of stainless.[6] Cerium fluoride was tested as an additive in the ladle last year. It was found to help workability and surface in austenitic steels containing titanium. No beneficial effects were noted with this material in stainless grades other than type 321.

### Ductile iron applications increase

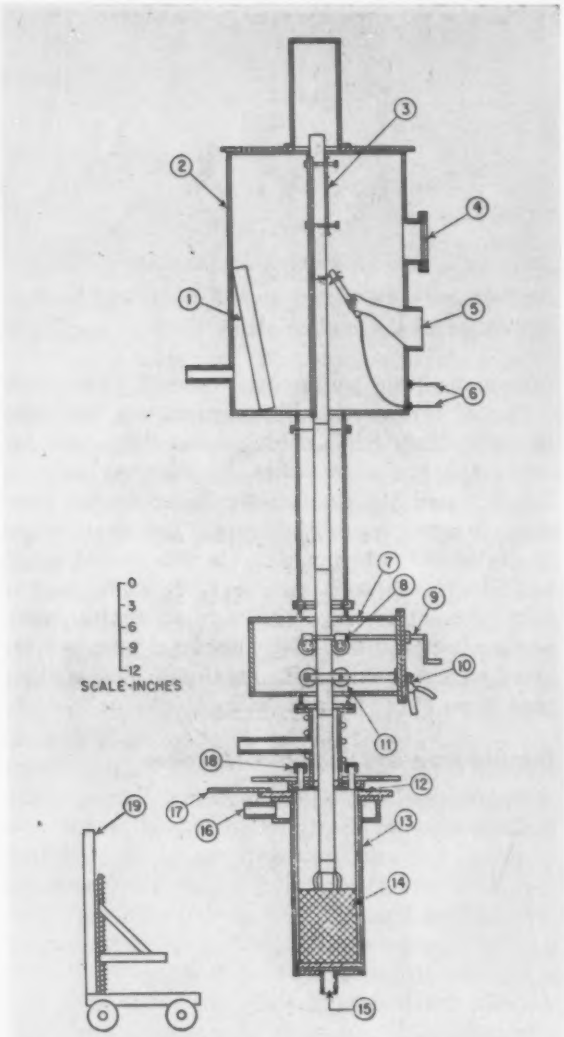
Ductile cast iron uses widened during 1953. Notable new applications include dies for cold forming, hot mill rolls and gears. Ductile iron bar stock was also offered by several companies for the first time. Hot extrusion of ductile iron will soon be possible, according to some sources. Wraps are still to be taken off the new nodulizing material for making nodular graphitic iron. The new material is reported to have worked out successfully in field applications with the result that production in large quantities is planned.

Titanium production increased during 1953 but demand still outstripped supply. Production capacity of 35,000 tons set by Defense Dept. earlier in the year was shaved to 22,000 tons. ODM later authorized the General Services Administration to contract for 25,000 tons of capacity. So far contracts have firmed up for 13,800 tons of capacity. Current production is running about 2300 tons per year.

Strong military demand spurred the building of more sponge producing facilities in 1953. Crane Co. early in the year started construction of a $25 million plant in Chattanooga, Tenn., for

the production of titanium sponge and alloys for the government. Crane eventually plans to use the plant's output in its own products when government requirements are met.

Target for partial production at the Crane plant is now set for early 1955 with full production in 1956. Crane Co.'s contract with DMPA calls for supplying 30,000 tons of titanium sponge within the next 5 years. Titanium Metals Corp. and du Pont have contracts with DMPA to supply 18,000 tons of sponge over the next 5 years. These three companies will be supplying the government with 13,200 tons of sponge by 1956.




**HAFNIUM-FREE zirconium production was gradually being taken over by private industry last year. Diagram of zirconium arc melting furnace shows: (1) electrode supply, (2) vacuum-tight tank, (3) aligning guides, (4) viewing port, (5) rubber glove, for bar joining, (6) welding power leads, (7) drive box, (8) drive rolls, (9) electrode drive crank, (10) main electrode power, (11) power application rolls, (12) insulation ring, (13) water jacket, (14) ingot in melting cup, (15) water inlet, (16) water outlet, (17) main power to melting cup, (18) eyepiece, (19) cart for removing cup assembly. ASM drawing.**

Re-use of titanium scrap is a major factor in increasing the titanium supply. Some fabricators are reported to have had some success in this direction. Titanium bars and sheet made from scrap are claimed comparable in quality with titanium made from ore.

The cost is still too high for widespread titanium use in industrial or consumer products. As sponge it costs $5 per lb, rolled out into sheets the price is $15 per lb. A commercial replacement for the Kroll process is still to be found. Magnesium substitutes such as sodium, sodium-mercury amalgam, calcium and hydrogen are being tried. Several firms are seeking an electrolytic method.

### Iron powder capacity expands

Terrific increases in production capacity marked 1953 as a big year in iron powder. A number of new firms entered the business and all old ones expanded their facilities. Among the new producers was Republic Steel Corp., the nation's first major steelmaker to enter the iron powder field. Their process was developed through research on direct reduction of iron ore.

Swedish and German processes were imported by Hoeganaes Sponge Iron Corp. and Easton Metal Powder Co., respectively. Hoeganaes has previously imported powder from its Swedish parent firm but this summer started operating its new plant in New Jersey with a capacity of 29,000 tons of sponge annually. A 600-ft gas-fired stationary tunnel kiln is used for sponge production. Easton's process, developed by Manisman Huettenwerke AG in Germany, uses steel scrap melted in a basic cupola and atomized with air and water.

### Develop ductile powdered metal

Complicated parts, including twists, undercuts, sharp notches and threads were formed directly to shape on a pilot production basis last year using a new powder metallurgy process developed by Utica Drop Forge & Tool Corp. The method requires only a compacting and sintering operation. A large number of parts produced require no machining, thus saving machining costs, time and material. Parts with more than usually difficult contours are made from carbides and hard-to-melt metals such as titanium and zirconium. Uniform density is attained throughout

A new powdered-metal product, Steel Oilite, was developed by Chrysler Corp.'s Amplex Div. This ferrous base material is reported to be the first powdered metal composition with ductility as well as strength in the range of low carbon steel.

While capacity far outweighs demand, producers aren't the least bit embarrassed about overexpansion. New uses, both civilian and military, continue to grow and producers don't want the stigma of insufficient capacity to scare off possible customers.

A new all-time high in aluminum production

was set in 1953 when the industry siphoned approximately 1.25 million tons of metal from its potlines. Expanded facilities made topping the million-ton mark possible for the first time. Aluminum capacity now stands at about 1.33 million tons annually.

Increased production, coupled with reduced military consumption and lower demand late in the year, took the edge off what earlier was a critically tight aluminum market. While producers had no trouble filling order books on many items, generally intensified sales efforts were in the cards for 1954.

Biggest cloud over the copper market in 1953 was the question of disposing of Chile's surplus copper stocks. During the extreme shortage, Chile has been charging 35.5¢ per lb f.o.b. Chilean ports. But as soon as metal became available elsewhere in adequate quantities consumers ignored the expensive South American source.

### Seek new magnesium applications

Higher import duties and possibly some sort of import restrictions were the goal of a great many in the lead and zinc industries last year. Contention is that cheap foreign metal drove domestic prices down so low that the industry was badly hurt.

Concerted attempts to find new and more extensive uses for magnesium highlighted efforts of this light metal industry last year. Reason for it was that the industry wanted no repetition of the post-World War II collapse it experienced.

As it was, production of primary metal was far ahead of demand and the government closed down five of its six plants in midyear. Only the Dow Chemical Corp.'s plant at Freeport, Tex., and the Dow-operated government plant at Velasco, Tex., continued production. Total output for the year was close to 92,000 tons as compared to 105,831 tons in 1952.

Private industry, with the encouragement of Atomic Energy Commission, was gradually taking over production of hafnium-free zirconium in 1953. Allegheny Ludlum Steel Corp. and Carborundum Metals Corp. are both now in production of hafnium-free sponge.

Entire output of hafnium-free zirconium is going into atomic reactors where its low neutron absorption makes it ideal. But industrial use was slow to catch on—primarily because of prices. However, commercial grade, lower cost zirconium is expected to be made available in fairly large quantities for industrial use within 6 months. Reports are that 500-lb ingots now being made will be surpassed by 1000-lb ingots and that the price will be competitive with tantalum.

Commercial metal, containing 2 pct hafnium, now sells for about $10 per lb in sponge form. Rolled out in sheets it's $27.50 per lb. Free of hafnium, zirconium sponge is said to be worth more than $20 per lb. Chief industrial uses are in the chemical and electronic industries.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2. Nickel: Free Market Pressures Build Up, Oct. 15, 1953, p. 86.
3. New Stainless Alloy Fills Long Industry Need, June 18, 1953, p. 149.
4. New Austenitic Stainless Good Alternate for 18-8, Mar. 12, 1953, p. 135.
5. How and Where to Use 430 Stainless, Feb. 26, 1953, p. 127.
6. Rare Earths in Stainless Brought Up to Date, June 4, 1953, p. 148.


## METAL POWDER SHIPMENTS, IMPORTS

### SHIPMENTS OF IRON POWDER

Total Net Tons, Four Major Classes*

| | Total | Bearings and Parts | Friction Materials | Magnetic Cores | Miscellaneous |
|---|---|---|---|---|---|
| 1944 | 1,720 | ..... | ..... | ..... | ..... |
| 1945 | 1,550 | ..... | ..... | ..... | ..... |
| 1946 | 2,485 | 1,350 | 30 | 415 | 690 |
| 1947 | 3,115 | 1,560 | 30 | 600 | 845 |
| 1948 | 3,520 | 1,885 | 25 | 990 | 820 |
| 1949 | 3,235 | 1,746 | 14 | 935 | 840 |
| 1950 | 3,942 | 1,570 | 23 | 1,611 | 738 |
| 1951 | 3,651 | 2,150 | 1.5 | 900 | 600 |
| 1952 | 4,048 | 2,109 | 1.0 | 336 | 1,002 |
| 1953† | 6,479 | 3,499 | 15 | 1,748 | 1,217 |

* Domestic. † Estimates.

### IMPORTS OF IRON POWDERS

Net Tons

| | |
|---|---|
| 1948 | 2,580 |
| 1949 | 3,108 |
| 1950 | 7,607 |
| 1951 | 12,850 |
| 1952 | 5,827 |
| 1953 | 6,447 |

### COPPER POWDER SHIPMENTS

Net Tons

| | Total | Bearings and Parts | Friction Materials | Graphite Metal Brushes | Misc. |
|---|---|---|---|---|---|
| 1945 | 9,550 | ..... | ..... | ..... | ..... |
| 1946 | 7,380 | 5,900 | 580 | 330 | 580 |
| 1947 | 8,700 | 7,170 | 615 | 365 | 600 |
| 1948 | 8,550 | 6,550 | 675 | 575 | 770 |
| 1949 | 7,014 | 4,374 | 1,156 | 450 | 1,032 |
| 1950 | 13,109 | 9,488 | 1,271 | 957 | 1,393 |
| 1951 | 13,571 | 11,013 | 963 | 390 | 1,205 |
| 1952 | 8,979 | 6,731 | 1,001 | 282 | 905 |
| 1953* | 11,008 | 9,670 | 778 | 433 | 929 |

* Estimate.

### SHIPMENTS OF LEAD POWDER

Net Tons

| | Total | Bearings | Friction Materials | Protective Coatings | Miscl. |
|---|---|---|---|---|---|
| 1945 | 5,185 | ... | ... | ... | ... |
| 1946 | 905 | 55 | 186 | 183 | 482 |
| 1947 | 785* | 53 | 185 | 187 | 380 |
| 1948 | 1,040 | 74 | 319 | 141 | 506 |
| 1949 | 790 | 88 | 315 | 210 | 350 |
| 1950 | 918 | 112 | 230 | 132 | 444 |
| 1951 | 1,280 | 415 | 380 | 110 | 375 |
| 1952 | 1,344 | 316 | 215 | 101 | 983 |
| 1953* | 1,480 | 144 | 477 | 161 | 698 |

* Estimate.

REVIEW | FORECAST

# PRODUCTION PROCESSES

**Outstanding developments in metalworking processes during 1953 . . . Significant production trends to watch for in the coming year.**

AUTOMATION — what the aircraft and automobile industries started a few years ago has now snowballed into this country's major industrial phenomenon. In the auto factories, automation now extends far beyond the machine shop and into the forge shop, press shop, painting department and the foundry. Automatic handling has also been applied to small assembly operations.

Meanwhile, appliance builders, toy manufacturers and many other segments of industry have adapted automation to their operations.

Several significant trends in the development of automation are apparent:

(1) Automatic feeding and ejection of parts to be processed in individual machines is progressing rapidly. This applies particularly to lathes.

(2) While the original application of automation was to machine tools, automation of press operations is now at least as common.

(3) Automatic assembly of small parts is getting the attention of many progressive manufacturers.

(4) Tying together of welders and presses has made noteworthy advances during the past year or two.

(5) The use of stop-and-go automatic conveyors, with highly selective features, has resulted in important reductions in the cost of materials handling.

(6) The trend is to turn each department of the plant into a completely mechanized, automatic operation, provided this can be done within the rules of amortization.

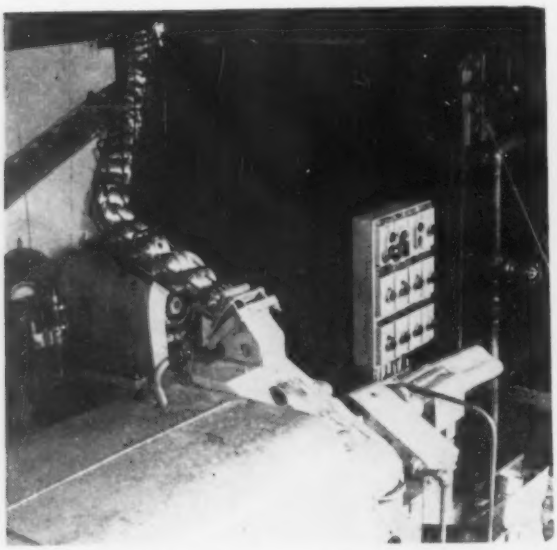
(7) There are two schools of thought about automation:

(A) If you automate, banks of parts should not be used.

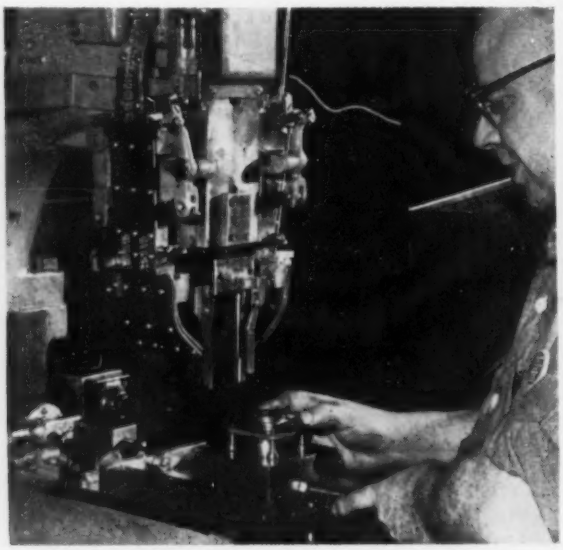
(B) Under some conditions, small banks of parts should be permitted to insure minimum production losses resulting from breakdowns.

Each approach has been successful although the most spectacular results have probably come where no parts banks are used.

Most of the big transfer-type machine tools in operation today are used to machine gray



AUTOMATIC parts processing on individual machines. Here, wrist pins holes are bored and work handled automatically in and out.



FOUR RIVETS are placed into a clutch release and assembled simultaneously. Formerly, inserting rivets was a time-consuming operation.

iron castings. The machines were designed to work together on a particular job. Tomorrow, it may be advisable to tie together machines to process steel parts that have, so far, either defied or greatly limited the use of automation. This is a large order but informed tooling experts agree such an accomplishment may be only a few years away.

Successful use of automation is largely depending on sound engineering study and forward planning, according to D. H. Harder, vice president, Ford Motor Co. As Harder points out, every product requires special consideration. Usually, an engineer or engineers who devote their energies entirely to automation are advisable. These men must have imagination and engineering knowledge; they must know design.

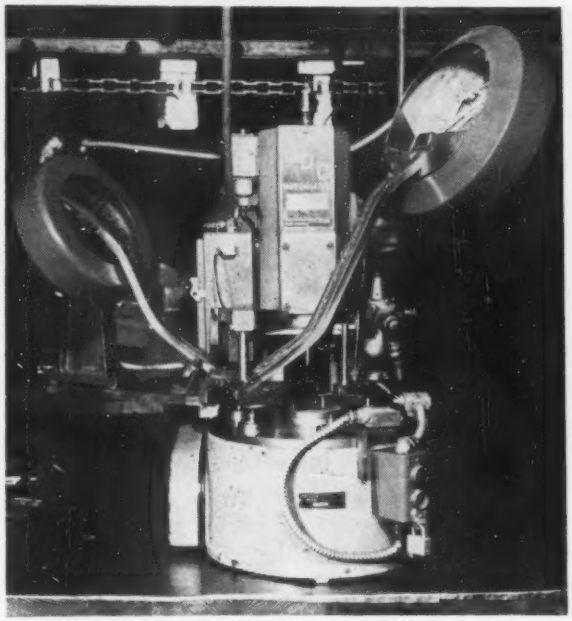
Experience often shows the right type of automation costs very little more than standard conveyances required for volume production, Ford experts say. Once a part has been studied thoroughly to determine its possibilities for automatic handling, an automation layout is made. At Ford, manpower requirements are analyzed *both with and without automation.* The results of these cost studies show the extent to which automation may be justified.

Once a Ford program is approved, automation engineers, members of the Processing Dept. Staff and tool and die engineers cooperate in working out the final design. Builders of machinery and equipment are consulted in working out standard heights and other features of the program.

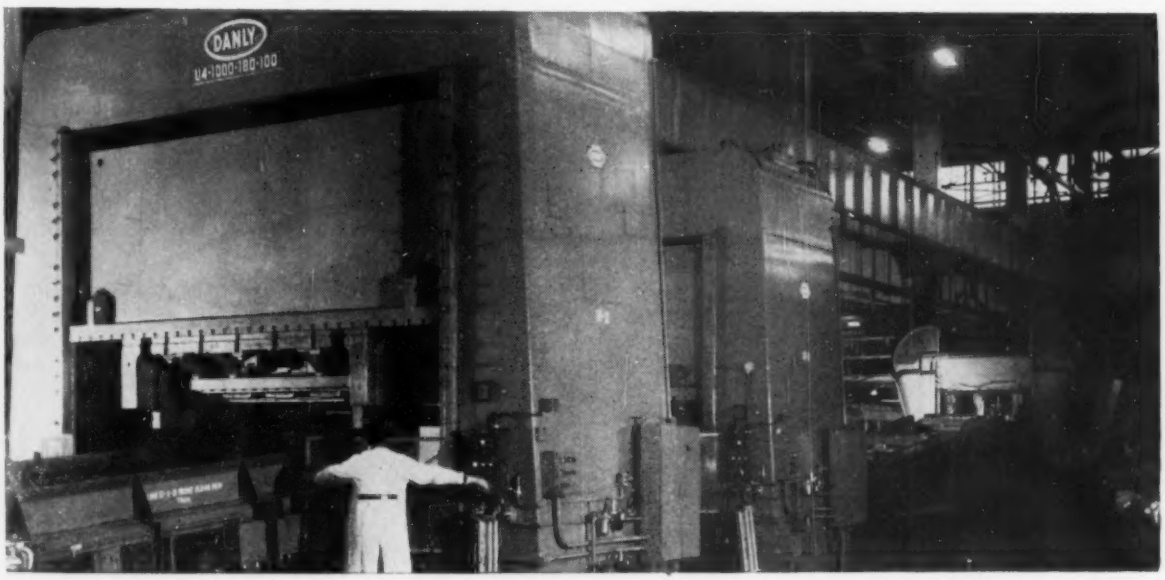
Eventually, it is expected that, in the automobile industry, outside contractors or separate departments will completely design, fabricate, pre-test and install all of the automation devices and equipment.

To justify the expenditure involved in automation, increased production, lower costs, better working conditions and other benefits must be forthcoming. Where a part becomes obsolete in a year, in the auto industry, the equipment must pay for itself in a year or less. On some major press lines and machinery lines for engines and parts, longer amortization periods are permissible.

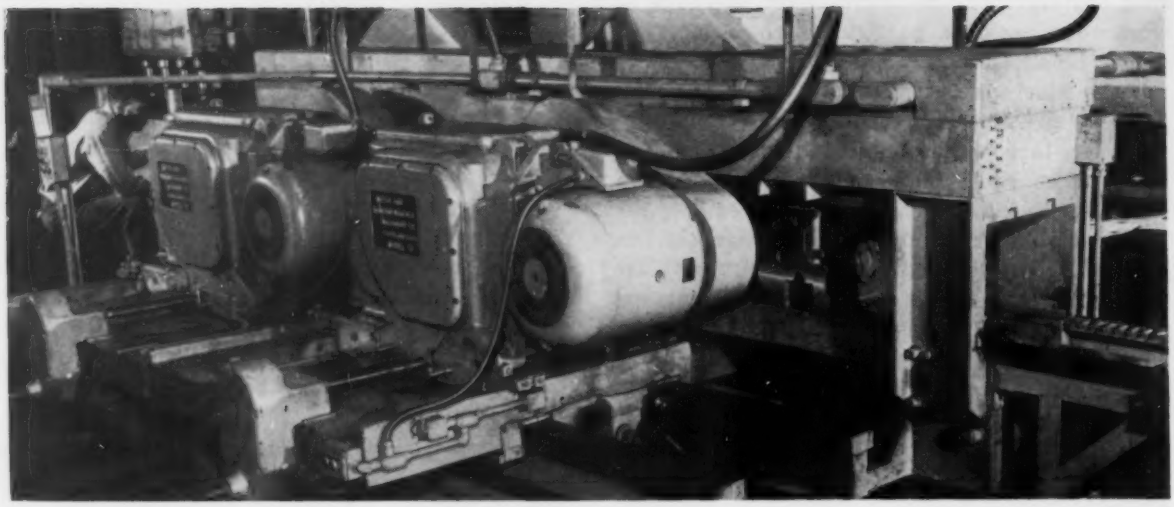
If there is any one secret to the successful use of automation it is expressed by two simple words: preventive maintenance. Accurate lubrication records must be kept. Life of perishable parts and tools must be accurately known.



FEEDING and assembling small plastic wheels in this machine has speeded operations considerably in a large toy manufacturing plant.




PRESS operations are becoming more automated. Above, in Ford Buffalo stamping plant, stampings are conveyed automatically to and from presses and to a battery of welding presses.



TRANSFER machines may soon be developed to process steel parts so far defying automation. Machine above combines rough and finish milling on ends of tractor cylinder block casting.

These parts and tools are replaced before they break down. Standardization of tools, use of pre-set tools, development and adoption of equipment design standards are important factors in the success of automatic handling.

The year 1954 is expected to see some spectacular new automated engine and press lines in the motor car industry. New press setups will be capable of handling up to 500 big stampings per hr. New index-type automatic sheet metal handling equipment will be employed.

Several large forging installations have already been automated. The number and size of identical parts to be produced actually holds the key to justification of completely automatic forging plants.

Small Tow tractors, operating without an attendant on a monorail, are now available which will deliver materials to any designated part of a plant.

A new chapter in automation of a plating operation will be written when a new bumper plating plant is completed in Detroit in 1954 or early 1955.

It can be expected that automatic painting, using electrostatic methods, will be adopted on a larger scale by the automobile industry during 1954. This method of painting is completely automatic and requires no spray booth.

Automatic feeding, turning, and ejection of steel parts, automatic assembly of small parts, automatic welding, gaging and inspection, are all gaining acceptance. Each of the developments has an important place in the rapidly evolving and changing picture of automatic processing.

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Automatic Assembly of Small Parts Saves Money. May 7, 1953, p. 206.

Transfer-type Machines Can Be Standardized. Feb. 12, 1953, p. 129.

Automtaic Feeding Device Speeds Machine Operations. July 2, 1953, p. 133.


FULLY-AUTOMATED line is used in welding reinforcements to top cowl assembly of Ford cars. Shuttle automatically moves each assembly from station-to-station and from press-to-press.

# MATERIALS HANDLING

**Management awareness of handling costs grows . . . Sales of equipment show steady rise.**

It appears that industry may have done more during 1953 to improve its methods of picking something up and putting it somewhere else than in any other previous year. At least estimates of record shipments by manufacturers of materials handling equipment seem to indicate this fact.

Management has become increasingly aware that the cost of handling materials is one of the few manufacturing expenses over which it still has a certain amount of direct control. And since it is generally agreed that the amount spent in moving materials averages about 25 pct of total product cost, production executives know increased efficiency in materials handling can save more dollars than improvements in most other production operations.

Backing up the belief that industry is more interested than ever in streamlining its handling methods is the upward tilt of charts showing sales and shipments of materials handling equipment.

C. B. Elledge, president, Material Handling Institute, estimates sales of all types of materials handling equipment last year climbed to $1.25 billion.

In surveying Conveyor Equipment Manufacturers Assn., THE IRON AGE learned that this group also had red-circled 1953 as the top year for conveyor shipments. Total for manufacturers of this type of materials handling equipment was estimated at $289 million compared with the previous 1952 shipment high of $268 million.

National Wooden Pallet Manufacturers Assn. also reports an increase in sales last year. Total for 1953 was estimated at $100 million compared with $74,250,000 in 1952.

Market prospects for this year are hazy. Some informed sources expect the materials handling industry to do $2 billion worth of business during 1954, but others believe slowed defense spending may force volume down from last year's $1.25 billion level.

Conveyor Equipment Manufacturers Assn. says it believes completion of industry expansion programs and slimmer defense spending support may reduce value of conveyor shipments from $289 million to $260 million.

Expressing greater optimism, National Wooden Pallet Manufacturers Assn. expects pallet sales to jump from 1953's $100 million mark to $125 million in 1954. For the industry as a whole, it believes volume may hit the $2 billion mark, particularly if industrial competition increases.

In addition to being a banner year for shipments, 1953 also marked development of what may become a trend in the materials handling industry—merger of companies making different types of equipment. Idea behind these transactions was to expand product lines so that a company can offer customers a more integrated range of materials handling units.

## Use of all conveyors grows

An example is Lamson Corp., Delaware, manufacturer of belt and roller conveyors which recently bought out Mobilift Corp., Portland, Ore., producers of fork lift trucks.

In another typical merger last year, a manufacturer of electric trucks for inside handling expanded its line to include gasoline-powered vehicles and purchased a company that makes outside handling equipment.

Among the many interesting developments in materials handling products last year were: greater use of magnetic conveyors, power and free conveyors; introduction of pneumatic tubes in many metalworking plants; electronic scales for weighing materials in transit; ultra-modernistic styling of fork trucks.


Materials handling trends to watch in the near future: increased use of electronics to control conveyors and packaging equipment in many plants.

Extension of automatic equipment to assembly operations is expected to place additional emphasis on better handling of parts at assembly.

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Industry: The Less Handling The Better, May 7, 1953, p. 139

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# EXTRUSION

**Producers will hot extrude more high alloys . . . Greater interest shown in shapes . . . Commercial cold extrusions.**

Technical progress in hot and cold extrusion of steel during 1953 probably surpassed any previous year in metalworking history. New production facilities were added and advances made in adapting these processes to a widening range of steel products. For the coming year, extrusion methods give every indication of becoming more competitive with standard fabricating methods.

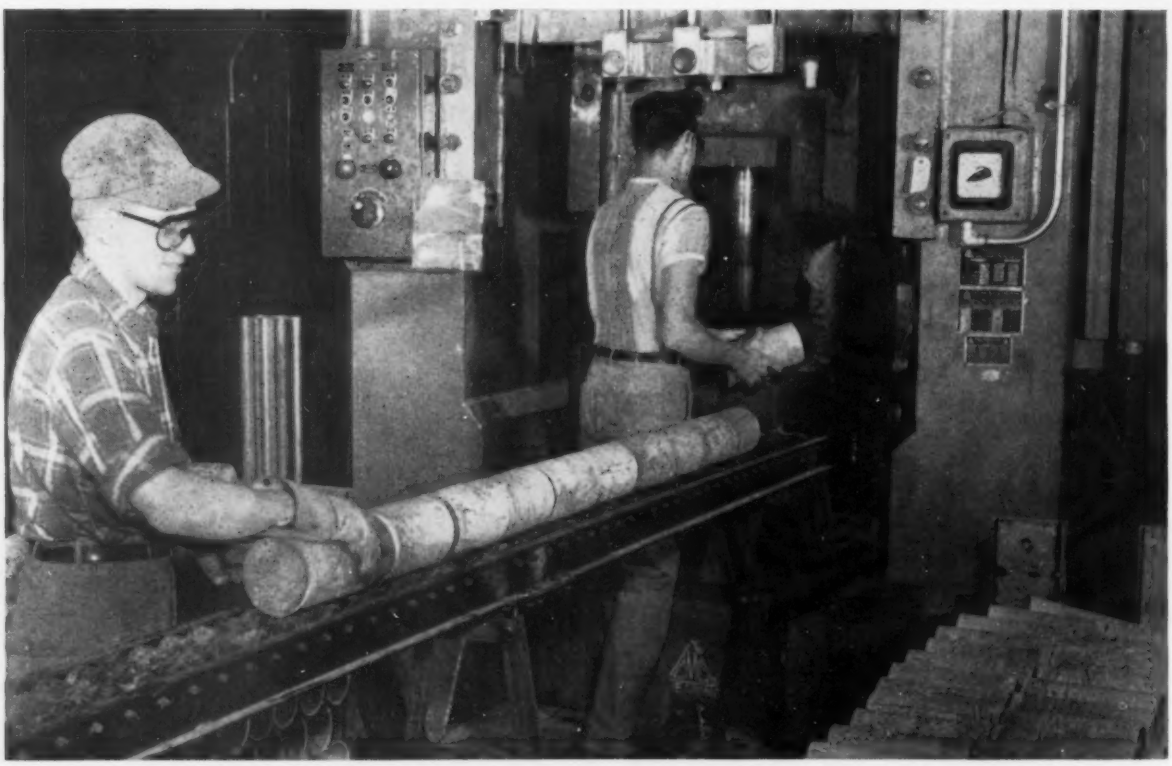
A major development in hot extrusion was the start of commercial production at Allegheny Ludlum's integrated hot extrusion plant at Watervliet, N. Y., during the second quarter. Hot extruded stainless and high alloy steel tubing is produced at the rate of 250 to 300 tons per month. Excess extrusion press capacity is being filled in with the production of high alloy and stainless shapes. All standard 300 and 400 series grades are used in production.

Other plants using the Ujine-Sejournet hot extrusion process include Babcock & Wilcox Tubular Products Co. which started production of stainless, alloy and carbon tubing early in 1952 and National Tube Co. which got into production in the latter part of that same year.[1]

Greater experience was gained during the year in extruding a wider range of materials. Experimentally, titanium, zirconium, tool steels and high temperature alloys have been hot extruded with good results. One producer reports that tool steel hollows will furnish a new product for customers now forced to buy a solid bar of drilled product.

While tubing accounts for the major part of hot-extruded tonnage, more and more interest is being shown in the production of shapes. Producers are expecting to economically handle more tonnage in high alloy materials that otherwise would have been only forgeable. Special shapes which can only be rolled economically in tonnages large enough to absorb $3000 to $5000 in roll cutting costs will be extruded for smaller orders. Even simple shapes some claim can be extruded in competition with rolling if the lot size is small enough so that roll costs and changing times are excessive.

As more is learned about lubrication, die design and wear steel extruded shapes are becoming more complicated. A hot-extruded alloy steel structural shape made by Harvey Machine Co. last year indicates the competitive possibilities of hot extrusion compared with other fabricating methods.[2] Extrusions of SAE 8630 steel were cut into 5-in. lengths, drilled and



FLOOR CONVEYORS used in Pontiac's cold-extruded rocket line are rubber coated and have concave rollers. Parts are shown moving forward toward press for second draw operation.

MATERIALS HANDLING between cold extrusion operations is becoming more mechanized. In shell line, above, note overhead conveyors. Commercial examples of cold extrusion shown at right.

installed on aircraft. Finished price for this fairly difficult shape was $8.90 (including drilling) as compared with $24.90 for previous parts made by machining. Extrusions have been produced up to 32 ft long with numerous configurations and from 0.100-in. to 0.907-in. section thickness. Largest shapes produced by Harvey are 4.5 in. across the top and 2.25 in. high. Relatively small tonnages involved in aircraft production are expected to result in more emphasis on extrusions.

Application of 60 cycle induction heating units for steel billets used in extrusion held the attention of several producers last year. One heater of this type can preheat both stainless and carbon steel billets 5 in. in diam and larger to 2300°F without the use of any high frequency generating equipment.[3] It may also be used with equal success on titanium and titanium alloys.

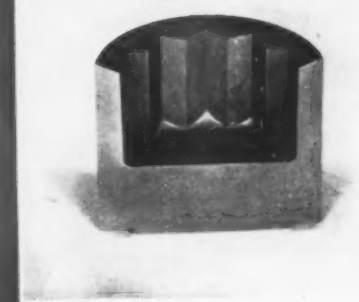
The number of cold extrusion presses operating today on civilian products is not a reliable barometer of interest in this method of producing high strength parts to close tolerances with virtual elimination of the heat treating, machining and finishing operations. Thus far, defense production has been the largest user of cold extrusion but commercial interest in the process is high.

Cold extrusion of steel made its first important invasion into commercial fields during 1953.[4] Mullins Mfg. Corp. with its new $2.5 million plant in operation, entered the hydraulics or fluid-power industry by making 3000 psi accumulator shells.

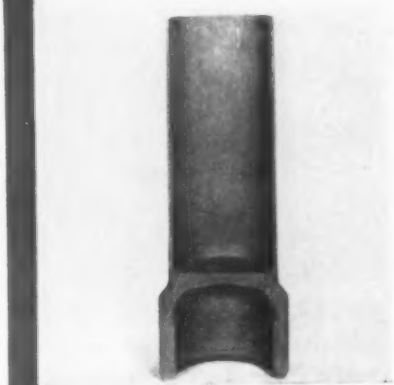
Cylinders made by Mullins require no machining, grinding or honing. Their cylinders

**Hydro-spring cylinder . . .**

**Heavy flanged sleeve . . .**

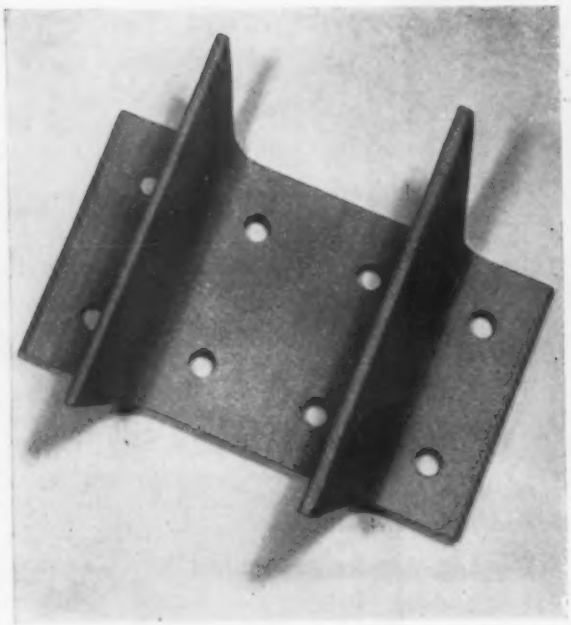


**Flutes or lands . . .**

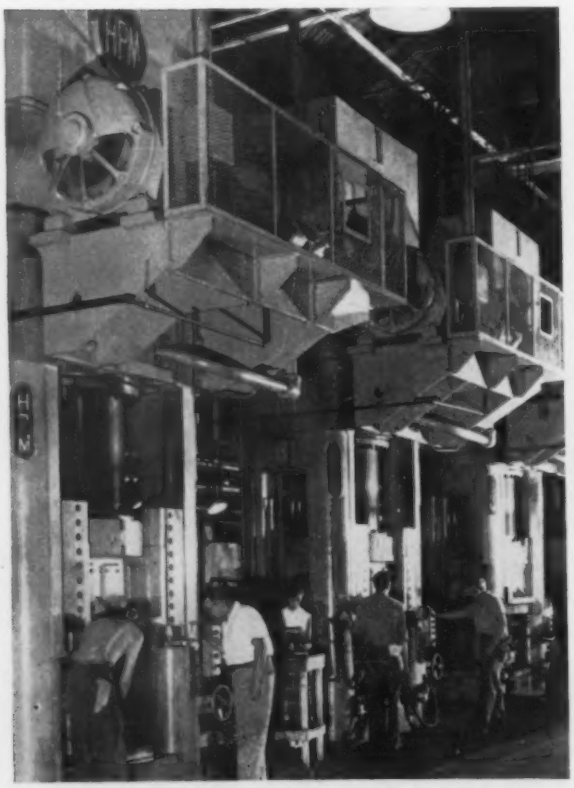


**Integral web . . .**

***Cold extruders of steel parts are actively trying to enter the commercial field . . . Auto plants are expected to use it in 1954.***



STRUCTURAL shape hot extruded from 8630 by Harvey Machine Co. gave big savings.



HYDRAULIC PRESS line at Mullins Mfg. plant contains four 1500-ton presses. Cold-extruded parts up to 26 lb can be made. Commercial applications of cold extrusion are increasing.

have integral bottoms with attaching stud or clevis already formed. Each piece is 22 in. long, has an inside diameter of 4¾ in. and weighs 45 lb. Tolerances on concentricity are 0.001 in. Cold extruded holes do not taper. Surface finish on Koldflo cylinders are claimed equal to the conventional honed surfaces as far as packing life or sealing characteristics are concerned.

### Cold extruded torsion tubes

Other cold extruders of steel parts are also actively trying to crack the commercial field. Mullins is concentrating on fluid-power cylinders, while Heintz Mfg. Co., Malloy and Cam Car Screw & Mfg. Corp. and others are taking a broad approach and are bidding on smaller parts of more intricate design. Mullins is supplying torsion tubes for new six-wheel tractor trucks. This is a precision cylinder, where the outside diameter is critical instead of the inside diameter, as in hydraulic cylinders.

Several auto firms are using cold extrusion experimentally. It will be surprising if at least one auto plant is not using cold extrusion in production during 1954. Thus far, there has been a problem trying to find parts where cold extrusion will be economical. Automobile transmission shafts, piston pins and rocker arms have been considered for cold extrusion. At the present time, only the automatic transmission shaft is being made commercially.

### New 60-mm mortar shell line

In the defense field, one new facility is the 60-mm mortar shell line set up by Oliver Corp. at Springfield, Ohio.[5] Five cold extrusion presses form a complete line for forming the 60-mm shells without the need for supplementing the line by draw or ironing operations.

Each of the five operations amounts to about a 65 pct production. The steel slug used to produce the shell by extrusion weighs only 1.58 lb while some forgings for the same shell weigh 4.25 lb. Savings in labor and material are considerable due to less machining.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2. Extrusion: Squeeze New Alloy Shape, Sept. 24, 1953, p. 59.
3. Induction Heating: Low Frequencies Have Advantages, Dec. 24, 1953.
4. Cold Extrusion Ready to Invade Metalworking Markets, April 23, 1953, p. 152.
5. Five-Step Extrusion Line Forms 60-mm Mortar Shells, Nov. 19, 1953, p. 147.

# INSTRUMENTATION

## Spectacular growth reflects industry trend . . . Use holds key to better product.

Industry's wide acceptance of improved measuring and controlling instruments is paving the way for a new industrial revolution. Application of new and better instrumentation as a means of cutting production costs and improving product quality has become part and parcel of the industrial scene.

Sales of mechanical measuring instruments have jumped 639 pct since 1939.[1] Sales of electrical measuring instruments are up 455 pct. Scientific instruments show a gain of 655 pct. Computers, recorders, controllers — engineers' dreams a decade ago—have come to life. Their use is closely linked to wider use of instruments by industry.

This spectacular growth in use of instruments of all kinds reflects industry's efforts to solve three basic problems: (1) How to get more output from the productive setup. (2) How to cut the unit cost of manufacture. (3) How to meet increasing stiff demands for improved product quality.[2]

Reflecting industry demand for improved instrumentation is the tremendous amount of research being done by the instruments companies. To develop new instruments capable of handling the complex factors inherent in modern industrial processes, the instrument industry is spending 6 pct of its sales dollar on research as against 2 pct by industry as a whole.

### More instruments built in

Industry has put enormous speed and power in the hands of its operators. On today's high speed machines, an operator often cannot react rapidly enough to make the necessary changes which would offset machine deviation. In the split second required for the human machine to sense and react, the modern high speed machine has had time to ruin a part or material.

More machine tools are being built with integral control units. Many manufacturers of machine tools have anticipated the growing acceptance of built-in instruments, especially those which exercise a control function.

Boon to all industries using finely ground materials is an instrument which gives quick, accurate analyses of particle size distribution in fine powdered materials. An operation which formerly required many man hours to complete, and with an accuracy of ±150 pct, has been cut to 15 min with an accuracy of ±3 pct.

Industry is demanding and getting improved instruments[3] for a variety of operations which are not directly related to production. Application of the strain gage principle to weighing operations has proved very successful. One steel company has used scales built around load cells using the strain gage principle for weighing coiled strip, scrap, molten metal and ingots.

Growing use of titanium has called for improved equipment capable of meeting new specific analysis problems. Development of the emission spectrograph, and the use of improved techniques for producing standard samples, have substantially aided in improving analytical control of titanium.

Counting speeds up to 4000 pulses per second are reported possible with a new counting tube. Typical applications include high speed counting for packaging, accurate timing by counting of 60-cycle line pulses, very high speed machine operations.

A simple accurate way to gage removal of metal to the last few tenths without stopping the machine or removing the part has been developed. A movement of 50 millionths in. can be read by the operator on a column type air gage.

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1. Instruments Spark Industrial Revolution, Oct. 8, 1953, p. 207.
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AUTOMATED PRODUCTION of resistors, capacitors, building blocks for electronic machines, at National Bureau of Standards.

# INVESTMENT CASTING

## Industry shows healthy growth . . . Research seeks improved production methods.

Investment casting, as an industry, is gaining a new maturity. There's a new recognition by the metalworking industry of the merits and potential of the investment casting process. The past 3 years have seen tremendous industry growth. Some older firms now employ as many as 700 persons in multiplant operations. There are now more producing investment foundries than there were during the first boom following the introduction of the process to industry little more than a decade ago.

Rate of expansion tended to level off in 1953. Price competition in certain industrial lines of foundry products became noticeable. While much expansion pressure was due to the Korean War, present industry status is sound. Approximately half of production volume is devoted to non-military castings for industrial use.

This contrasts sharply with the first boom in the industry which was almost entirely due to military demands. Many products were originally converted to investment techniques to get most parts from a given allocation of metal. Often this experience resulted in permanent changes in design and procurement thinking favoring investment casting of small intricate parts. This holds true even for the most machinable alloys.

### Jobbing foundries grow

A dozen jobbing foundries in current operation now employ between 100 and 700 persons. These are major sources for industrial investment castings. About 20 more independent investment foundries employ up to 99 people. Some 50 captive foundries produce investment castings solely for parent companies.

Turbine blade castings still account for more than 50 pct of overall dollar volume of investment production. Unitwise, products for less highly stressed military products and general industrial consumption outnumber blades considerably. Number of parts produced for non-military use exceeds those produced for military purposes. But total dollar value of industrial production represents less than a third of the total industry income.

Recent development of new high nickel, high-chromium alloys in which cobalt is less important has favored use of precision castings as a means of producing turbine buckets. Although the overall picture of strategic metals use is not particularly improved by the new alloys, the parts being cast have shown worthwhile performance improvements. These new alloys are more difficult to forge than the cobalt base alloys. Investment casting has proved a satisfactory method of making turbine buckets from these new alloys.

Major improvements in such highly stressed objects as the "hot end" turbine bucket can no longer be expected from manipulation of alloy composition, according to some trade sources. Rather, major performance gains must entail utilization of controlled environment melting and casting techniques.

Several research programs are aimed at reducing costs of investment casting production. Some researchers believe the ceramic shell mold may be used to replace the solid investment blocks now generally used. Similar in principle to the mold, used in the frozen mercury process, the ceramic shell could afford an important technological advance which would both reduce costs and improve quality.

### Lower shell costs sought

At present it is only possible to make a ceramic shell by the frozen mercury pattern technique. Universal application of a ceramic shell is prevented by chemical and thermal properties of wax or plastic patterns.

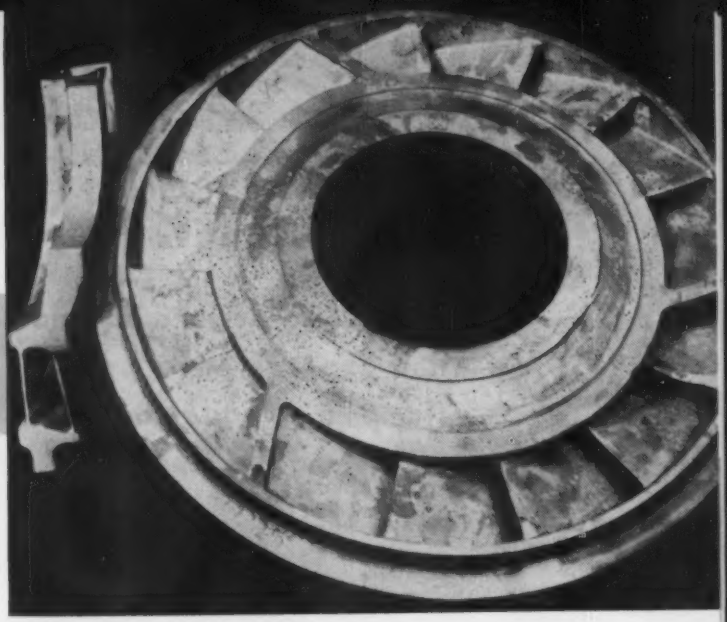
Costs factors which have limited utility of the frozen mercury process are being attacked from two directions. Special surface oxidation treatments of "soft metal" compositions to overcome the tendency of liquid mercury to amalgamate with the alloys have been favorable on a laboratory basis. If production tests are satisfactory, it may be possible to use the soft metal diemaking technique for production of mercury patterns.

This will broaden the field considerably, as high die costs entailed in production of extremely precise steel dies presently required to form mercury has been a limiting factor. The high costs of materials required in the special refractory slurry used to form the ceramic shell mold over the mercury pattern are also being studied. An intensive study of the functional relationship of all constituents in the investment, with particular emphasis on the costly vehicles used, is aimed at cutting production costs and making possible wider use.

### Pattern extraction studied

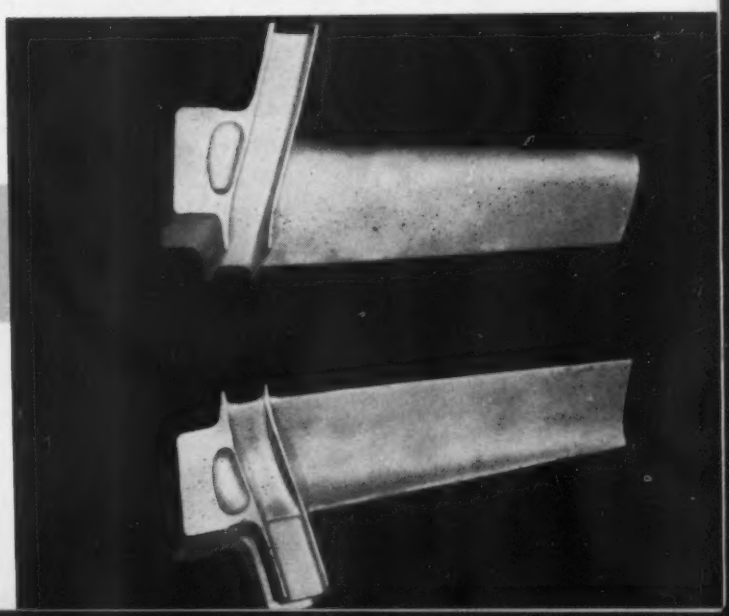
At least three major investment foundries using wax and plastic patterns have research projects under way to solve the problem of extracting such patterns from unfired "green" investment shells. Solution of the thermal problems involved would permit a major reduction in foundry costs and help improve casting quality.

There's a more general recognition of the value of investment forming as a means of avoiding costly machining and assembling operations in small, intricate metal parts.



MORE THAN 10,000 of these 17-lb type 310 stainless steel turbo-boost diaphragm castings have been produced. They are held to close physical and dimensional tolerances.

POURING a 20-lb melt of stainless steel into an air centrifuge, a method used for special purpose casting production. Pouring in flask molds normally relies on gravity or gravity-suction.



TUBINE BLADE production is the largest single phase of investment casting. The controlled environment casting of blades is expected to lead to improved blade quality in the future.

# STAMPING

**Press designers and automation experts have pushed stamping production rates far beyond previous limits . . .**

Fast mechanical presses equipped with Dynamatic clutches, increased use of automatic loaders and unloaders, and tying of presses to welding and assembly operations were among the outstanding developments in metal press work during 1953. During the year, plastics got a lot of attention even though the production abilities of plastic dies are yet to be established.

Chevrolet's limited volume production of a plastic sports car body using iron dies is a significant development that should be followed closely. Other processing innovations getting justified attention during 1953 were: (1) the development of a simple device for pre-testing the drawability of a sheet before it went into the press and (2) increased use of progressive dies for big production parts not subject to frequent design changes.

The possibility that a new mechanical press equipped with a special clutch and reliable, fast controls coupled with ingenious mechanical and hydraulic press loaders and unloaders could produce up to 500 or even 600 automobile doors, hoods or bonnets in an hour probably never occurred to a press shop superintendent as recently as five years ago. Today, this is an accomplished fact. At Ford's new Buffalo plant a number of presses are capable of running 14 strokes a minute. The new Fisher Body Willow Springs will undoubtedly establish many new records in skillful and efficient handling of big press operations. Big presses already off the drawing board will run 16 strokes a minute.

### Coated steel reduces breakage

Assuming automation moves ahead as now seems probable, big automobile press plants may someday find it possible to utilize one shift operation in many departments where two-shift crews and overtime have always been used. This will be accomplished despite higher production schedules that are anticipated in the years ahead.

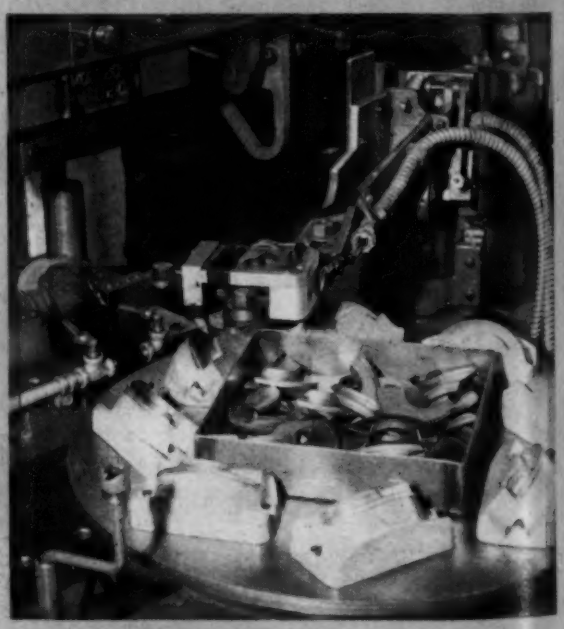
The motor car industry has made it pay to handle even the smaller pieces in its automatic handling devices. At its Hamilton, O., plant, over 85 pct of the smaller Fisher Body presses are equipped with some type of automatic-handling device.[1]

Much study has been given to improving drawability of a sheet of steel in a die. For this purpose, the press shop has an interesting new tool—a simple, portable device that can be used to pre-test the drawability of steel before it goes into a die.[2]

Another approach to the problem of producing a larger number of acceptable parts from a draw die is to use coated steel. Properly applied zinc or phosphate coatings permit more severe draws and minimize breakage.[3]

Short run parts can often use plastic tooling to advantage although the length of the run and the type of draw is still unpredictable. Plastic tooling has clearly established the following factors in its favor: (1) jobs can be tooled up quickly, (2) where sheet metal forming rather than severe or moderate drawing is involved, plastic dies may prove to be quite satisfactory for short runs, (3) until more experimental work has been done, cost factors of plastic tooling are going to be difficult to evaluate.

A number of short run parts have been run successfully on plastic tooling.[4] New techniques are being developed almost every day. Lack of knowledge of the process has thus far limited the number of applications. Inability to do the job themselves or to place plastic tooling with outside firms has also limited the



**RESTRIKE press equipped with a swinging arm is designed to pick up stamping, put it in die.**

use of plastic tooling, by the motor car industry. Meanwhile, research is moving steadily forward. Brand new car designs as well as many new tooling methods are virtually certain to come from this research effort, but these developments are at least a year or two away.

Plastic dies should be regarded for the present as a new, short run, production tool and not as a big volume tool. While future developments may change this situation, the fact that hard die production is going up to 500 pieces per hr only emphasizes the kind of competition plastic tooling will have in the future.

Replacement of steel sheets with plastic body sheets is just beginning in the auto industry. The problem here is to (1) increase the production rate, (2) obtain satisfactory die life, (3) avoid high painting costs, (4) reduce production cost.

### Plastic fixtures economical

Probably the most immediately promising development in plastic tooling is the use of plastic checking, drilling, assembly and welding fixtures.

This application for plastics is today a proven application from the standpoint of economy, lead time, accuracy and service life. Only lack of knowledge of plastic tooling techniques and a lack of facilities seems to be holding back plastic fixtures.

Progress is continuing in the field of progressive die development. New setups often produce important increases in output.[5]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[1] Automatic Handling of Smaller Pieces Pays Off in Stamping. May 7, 1953, p. 232.

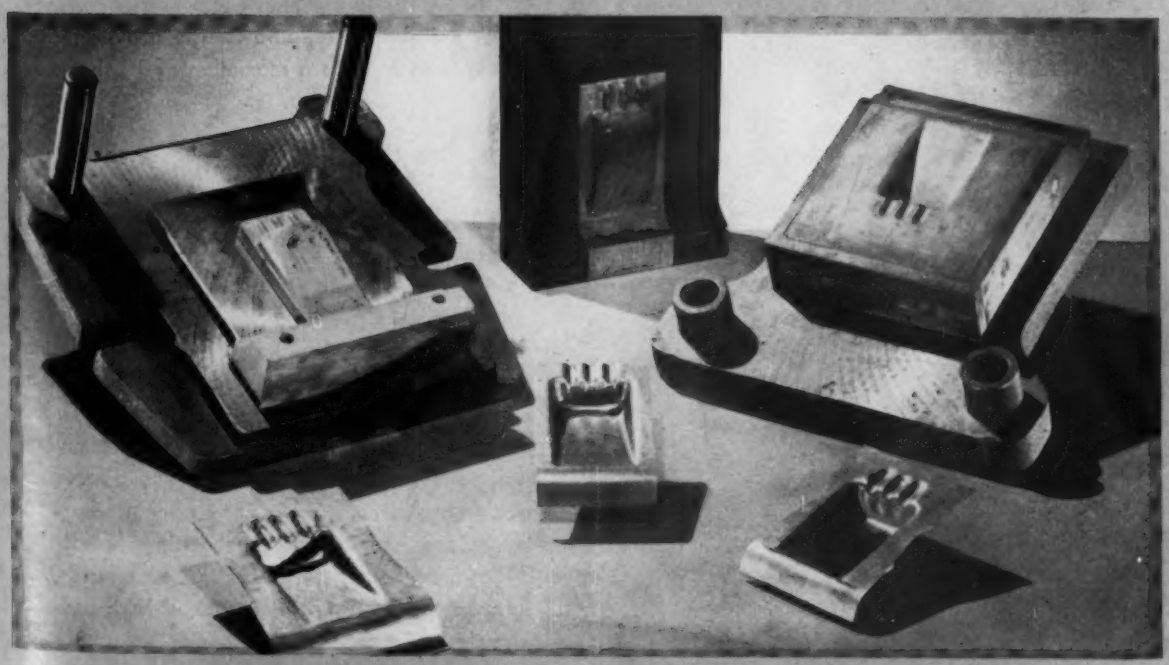
[2] New Test for Steel Drawability. Mar. 19, 1953, p. 143.

[3] Coated Steels Can Cut Breakage on Drawn Parts. Aug. 13, 1953, p. 135.

[4] Short Runs at Low Cost With Plastic Tooling. Feb. 19, 1953, p. 115.

[5] New Setups Speed Production of Stampings. Aug. 13, 1953, p. 143.


DRAWABILITY of sheets prior to stamping is checked simply and accurately with Flex-Tester.



CAST PLASTIC stamping, forming and drawing dies are advantageous for short runs or experimental work. Rezolin plastic draw dies, above, produce a small stainless stamping.

# HEAT TREATING

**Trend to shorter heat-treat cycles, leaner steels and selective hardening . . . More effective use of salt bath.**

Extended use of selective hardening, increased efforts to control and utilize favorably trapped stresses in parts, precise control of furnace atmosphere at the point of operation and more effective use of salt baths and batch-type furnaces are well-established recent trends in the field of heat treating. The use of field physical testing instead of laboratory testing is increasing.

Other developments in heat treating are being stimulated by the times. Metallurgists, for example, are determined to make each pound of alloy work harder. They want more alloying effect per dollar. Cost-conscious engineers have found that if the atmosphere is controlled clear through the quenching operation, the part comes out bright and cleaning expense is reduced. Furnace maintenance has had careful scrutiny; the increasing use of cast refractories is one answer to this problem.[1]

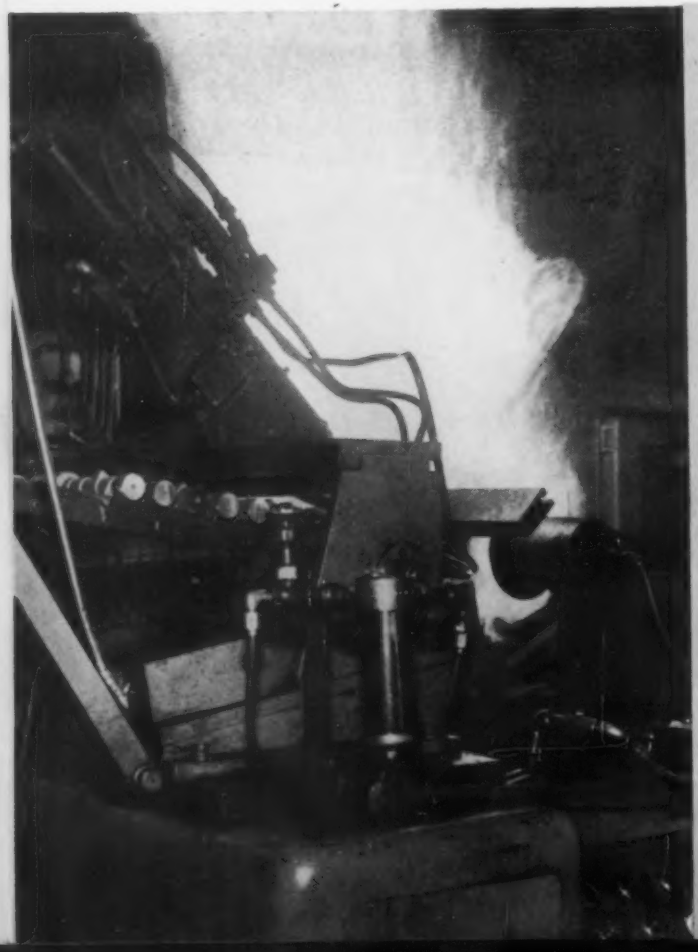
The strong tendency of the automobile industry to shorten its heat-treat cycles and avoid using alloys wherever possible is indicated by the fact that each of the Big Three auto producers plans to harden its axles with induction heating during 1954.

Applications of both induction and flame hardening have increased tremendously since the end of the Korean war and the end is nowhere in sight. While the big volume of automotive work is undoubtedly a factor in furthering this trend, the favorable stress pattern setup on the part during hardening as well as precise control are equally important.

Axles should now be added to camshafts and automatic transmission parts in the list of induction hardened parts. There are also installations using induction heating for forging or annealing. Taken together with a growing number of sintering operations this gives induction heating a prominent place in the automotive heat-treat picture.

Where the volume of parts produced is large and the probability of a design change is remote, Detroit now looks at selective hardening as one of the first considerations.

Distortion has always been a trying problem for the production heat treater. The salt bath appears to be a satisfactory answer for many problems where speed of heating and uniformity of heating are critical. For example, Continental Motors[2] is using fast salt bath heating for production-hardening of its big precision-built camshafts for tank engines. The same equipment handles four different shafts.



FEEDING of camshafts into this flame-hardening unit is completely automatic. The gravity magazine-type rack holds a maximum of 15 shafts.

MODERN heat-treating installations must be carefully planned. Diagram above shows how Fairfield Mfg. Co.'s gear heat-treating department was laid out with view to simplified handling of materials. Equipment includes: A, Pusher-type cycle annealer; B, batch-type oven annealers; C, pusher-type normalizer; D, pit-type annealing and hardening furnaces; E, pusher carburizer and washer; F, pusher-type direct-fired pack carburizers; G, batch, pack carburizers; H, rotary hearth clean hardening furnace; I, direct-fired rotary hardener; J, batch hardening furnace; K, RX atmosphere generators; L, 6-station dewpoint recorders.

During the past year salt baths have also played a prominent part in the further development of a successful aluminum dipping process. A number of defense installations are using salt baths for fast, uniform heating. Salt baths are being employed for stress relieving in several new and important cold extrusion operations. An example is the 100 pct conveyorized rocket installation at Pontiac Motor Car Co.[3] Ajax annealing furnaces containing up to seven separate conveyors are used.

## Salt bath popularity grows

Salt bath descaling and desanding of steel castings is also increasing. Meanwhile, salt bath heating continues to pile up its popularity for treating tool steels. A recent survey shows that 110 out of 138 installations for high speed steel selected salt bath heating.

Much attention has been given to carbon control during heat treatment. A determined effort is being made to give the metallurgist complete control of the operation during the entire cycle. There are two approaches to the problem: (1) continuous measurement of the carbon potential and (2) continuous measurement of the dew point. Each method has been used successfully. Satisfactory dew point controllers are not yet commercially available. Meanwhile, it is expected that both methods will be used by an increasing number of heat-treat shops.

The day when a heat-treat department was made to operate economically and efficiently simply by assembling the necessary pieces of equipment is fast disappearing. Modern heat-treat installations must be carefully planned—every step of the way.[4] Close liaison between design, heat treating and production departments is essential.

Metallurgists in high production plants are learning to use batch-type furnaces more effectively. They have learned that the batch-type furnaces may have some advantages over a long, continuous furnace from the standpoint of faster warmup and ability to meet a variety of demands for heat-treating service.

In a period in which economy of operation is highly important, faster quenching oils have received a lot of attention. In borderline cases, for example, the new fast-quenching oils are sometimes all that is required to change a troublesome operation into a satisfactory quench. The use of fast oils like Houghto-Quench K for parts heated by induction is also increasing.

While a microscope is still a highly valued piece of metallurgical equipment, the trend today is to test full size parts in the field wherever possible rather than to rely entirely on studies of the structure under the microscope.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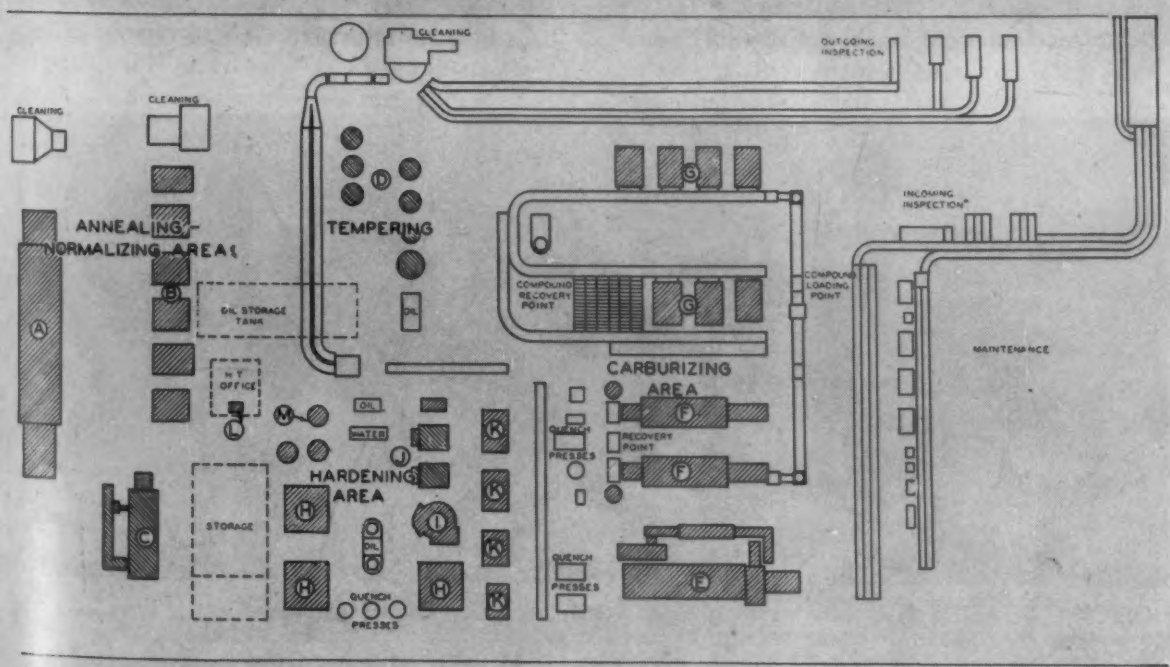
2. Heat Treating Facilities Provide Versatility, Rigid Control, Oct. 29, 1953, p. 106.
3. Conveyors Carry Cold-Extruded Rockets to High Production Level, May 7, 1953, p. 225.
4. High Output of Quality Gears Requires Tailor-Made Shop, June 4, 1953, p. 141.

# MACHINING

**High speed machining gains wider acceptance . . . Automatic parts handling increases . . . Machinability research . . .**

Increasing use of higher speeds and feeds, automatic work-handling devices and built-in gaging and inspection units headed machining progress last year. Cutting oils and coolants as well as coolant cleaning, refrigeration and central supply systems also came in for a great deal of attention to meet demands of higher production at less cost.

Once cautious experiments in the use of high-speed machining are more and more being translated into standard practice. Faster, more powerful machine tools, cutting tools of better design and manufacture, more knowledge of coolants and cutting fluids, and new machinability studies have stimulated the trend toward faster metal removal at lower cost.[1]

Development and application of more automatic work-handling devices for use on standard machine and semiautomatic tools is growing. Aside from the obvious cost-cutting benefits which result from reduced manual handling of work-pieces, other advantages include improvement of product quality and lessening of operator fatigue.

Faced with constantly changing parts and short production runs on a wide variety of machining operations, the jig and fixture experts continue to apply unique and flexible work-handling setups to their standard machine tool equipment.[2] Chutes, slides, hoppers, cam actuated indexing mechanisms, air vises and other work-handling components are being pressed into service.

Progress in reducing cutting and work handling cycles was accompanied by a trend to more automatic gaging and inspection.[3] While most automatic gaging and sorting machines are not tied directly into manufacturing setups, an increasing number of gages are being installed directly into production lines. Advantages include faster inspection, fewer rejects due to operator error, reduced operator fatigue, greater accuracy and lower inspection costs.

Built-in gaging devices which control machining operations to produce parts within tolerance are now applied mostly to grinders. However, the success of these applications will assure gage controlling devices a thorough trial in other machining operations.

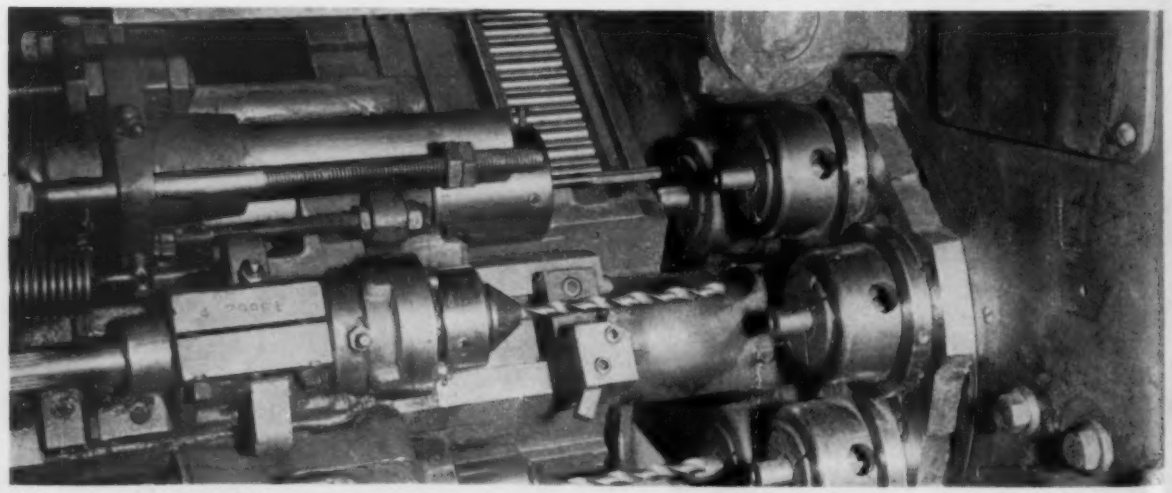
Machinability studies came in for a good deal of attention in 1953. Microstructure as an index to machinability is gaining wider acceptance. Machinability ratings based primarily upon composition and hardness are often at variance with machining characteristics encountered in actual production.

### How to machine titanium

Test results from a research program conducted by the Steel Founder's Society of America showed that a 100 to 200 pct increase in cast steel machinability can be obtained with proper heat treatment, and that hardness alone cannot be a definite guide for predicting machining characteristics.[4]

Another research program conducted last year by Watertown Arsenal showed that boron steels possess better machining characteristics than equivalent standard steels. The difference is usually more pronounced when cutting with high speed tools rather than carbides.[5]

More was learned about machining titanium alloys last year.[6] Tests on tapping, milling, and broaching Ti-150A and Rc-130B alloys in 1953



HOPPER MAGAZINE feed cuts handling time, boosts output on this six-spindle automatic lathe.

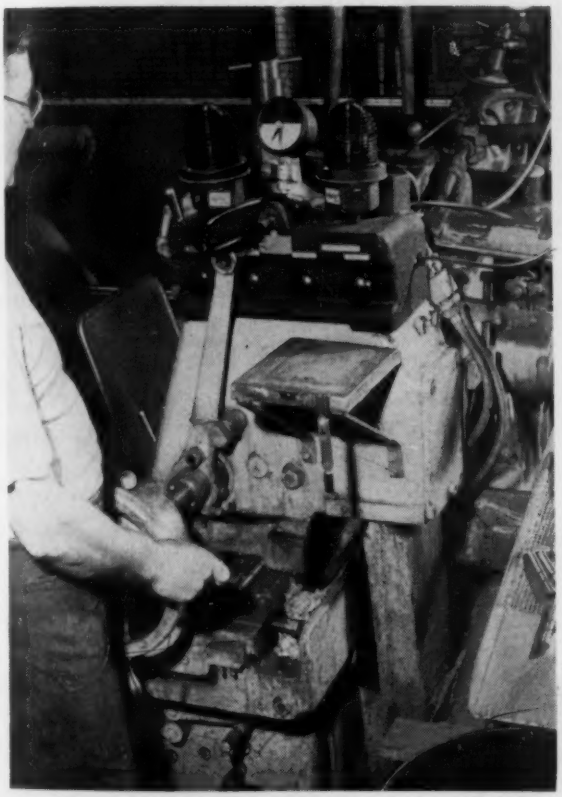
showed the most effective machining procedures for these alloys. For tapping, a skip-tooth, three-flute tap is claimed most practical. Power tapping should be used wherever possible, and rigid setups are extremely important. Optimum thread engagement is 1½ times tap diameter.

In milling titanium, heavy cuts, low speeds and coarse feeds are desirable. High speed steel tools, particularly 18-4-2, are most efficient. Tungsten carbide has not proved sufficiently tough to withstand interrupted heavy cuts. Climb cutting was found to be most practical, and face milling is recommended wherever possible.

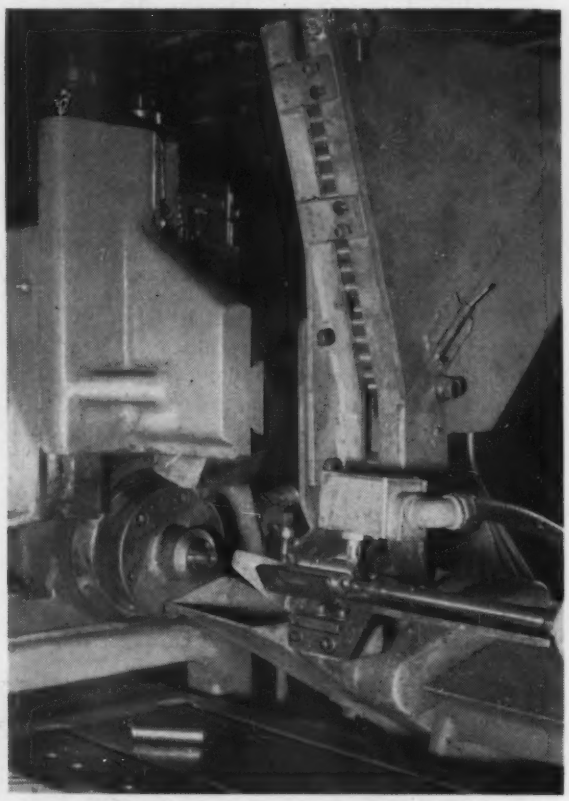
Titanium with high Rockwell hardness tends to bind and resist broaching cuts, therefore alloy hardness should not be over 37 RC. Both dovetail and angle broaches can be used in one-pass operations where rigid tool and work setups are provided.

Improvements in cutting tool design and manufacture in the past year went hand-in-hand with attempts to increase machining speeds. New studies of the characteristics of chip formation and of tool temperatures generated at high velocities have, in some cases, meant changes in machine design.

Interest in the subject of high-rake milling continued in 1953. Discarding tradition in favor of much higher rake angles on milling cutters has frequently produced cost-saving advantages in



GAGE controls and adjusts grinder for accurate production. If parts vary from allowable tolerances, the machine shuts down automatically.



FASTER handling with a hopper feed and an air chuck results in greater output of valve guide bushings on this single-spindle lathe.

## RATING THE NEW MACHINING PROCESSES

| Machining & Grinding Operation | Electro-discharge | Electrolytic | Ultrasonic Abrasive | Silicon Carbide Belt | Silicon Carbide Wheel | Diamond Wheel |
|---|---|---|---|---|---|---|
| Cemented Carbides | Yes | Yes | Yes | Yes | Yes | Yes |
| Metals (e. g., steel) | Yes | Yes | Yes | Yes | Yes | No |
| Non-Metals | No | No | Yes | Yes | Yes | Yes |
| Large Areas (over 4 sq in.) | Yes | Yes | No | Yes | ? | Yes |
| Small Areas (under 4 sq in.) | Yes | Yes | Yes | Yes | Yes | Yes |
| Small Diam. Deep Holes | Yes | No | Yes | No | No | No[1] |
| Cut-off | Yes | Yes | Yes | No | Yes | Yes |
| Embossing | Yes | No | Yes | No | No | No |
| Off-hand | [2] | Yes | ? | Yes | Yes | Yes |
| Fixed Feed | Yes | Yes | Yes | Yes | Yes | Yes |
| Form Grinding | Yes | Yes | Yes | No | Yes | Yes |
| Tapping | Yes | No | Yes | No | No | No |

[1] Loose diamond powder can be used for small diam. deep holes, but not wheels.
[2] Recent developments indicate that off-hand grinding by electro-discharge techniques is practical but it has not as yet been fully proven in the field.
Source: Minerals & Metals Advisory Board Report No. MMAB-54-C.

terms of higher speeds and feeds, longer tool life, reduced power consumption, better finish and greater machining accuracy.

Faster machining speeds and higher surface finish requirements are spurring efforts to find better coolants and cutting fluids. As machining speeds increase, tool lubricants with better, more uniform cooling and penetrating qualities become necessary. Use of liquid carbon dioxide as a coolant remains to be fully tested.

Advantages of coolant cooling and cleaning units as well as central coolant supply systems also received increasing recognition last year.

Dimensional problems in producing close tolerance parts made of magnesium, or other materials susceptible to dimensional changes due to temperature variations, have been overcome by the use of coolant coolers. Increased production and less downtime for cleaning and repair are advantages of refrigerating units selected to fit the job. At Chrysler Corp.'s new automatic transmission plant at Indianapolis, Ind., a central coolant system supplies 150 production grinders. It is paying off in lower grinding wheel costs, better finishes and almost complete recovery of soluble oil.

Automation, which has been widely applied to single purpose transfer machines is gradually being extended to cover a wider range of machine tools. An industrial tape recorder developed last year which records motion data rather than sound, is expected to double production output of skin-milling machines. A skilled machinist or tracer control operates the skin-miller through the necessary series of motions to produce the first piece of work. These motions are recorded electronically on the magnetic tape.

When the tape is played back through the machine it automatically duplicates the original motions and produces a part identical to the one used to make the recording.

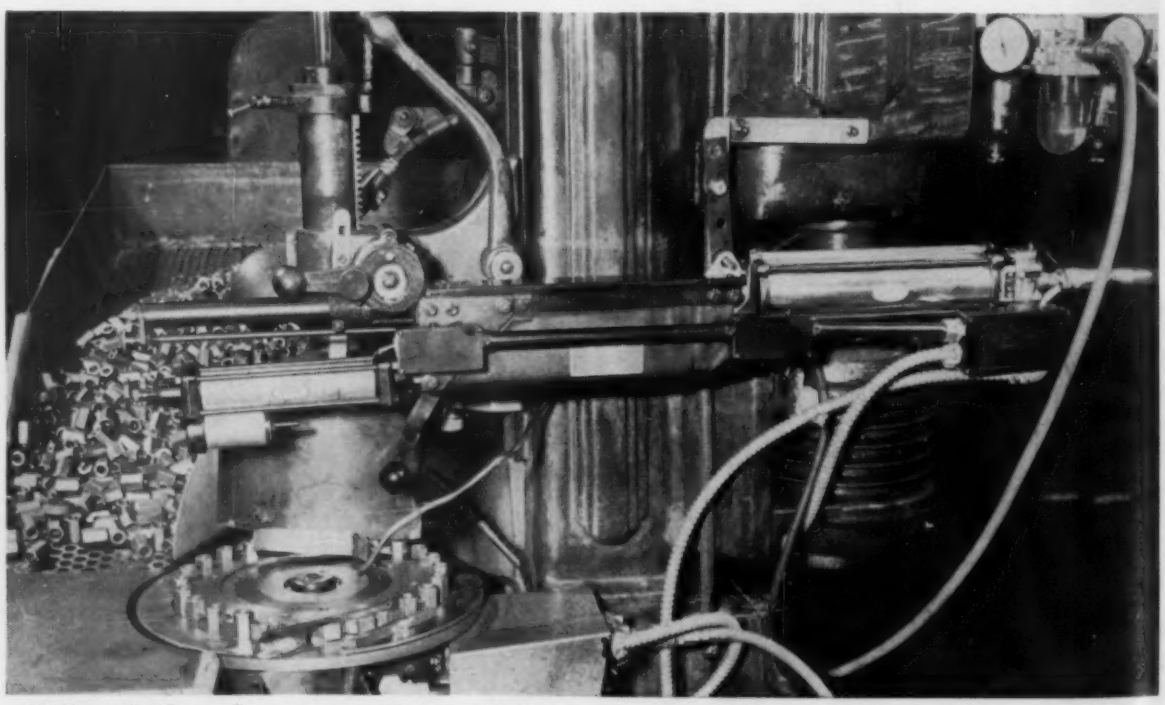
Research on new machining and grinding processes accounted for about $2¼ million of industrial research and development funds in 1953. This is almost twice the amount invested in 1951. Progress in machines and applications was evaluated in a year-end report by the Minerals & Metals Advisory Board of the National Research Council.

Processes being investigated include: (1) electro-discharge processes (including electro-sparking and electro-arcing); (2) electrolytic processes; (3) ultrasonic abrasive grinding. Industry is striving to bring these new machining and grinding methods out of the experimental stage to the point of limited production and field testing. Trade acceptance is slow, but progress is being made.

The chart on p. 329 shows the capabilities of the new methods in performing machining and grinding operations on the materials listed. Ratings do not take into consideration cost, performance, equipment availability or trade acceptance.

THE IRON AGE REFERENCES


1. "How to Increase Automatic Screw Machine Output," Dec. 24, p. 82.
2. "Flexible Tooling Handles Wide Variety of Parts," Oct. 15, p. 126.
3. "Gaging and Sorting," Oct. 8, p. 274.
4. "Machinability Studies Compare Cast and Wrought Steels," Jan. 22, p. 102.
5. "How Do Boron Steels Compare in Machinability," Oct. 29, p. 94.
6. "How To Tap, Mill and Broach Titanium," March 5, p. 186.

DRILL PRESS produces more with air cylinders to clamp workpieces, advance indexing dial, raise and lower the drill. Finished parts drop through an indexing dial into the chute.

# MELTING

## Wider use of vacuum melting seen... Cleaner metals needed for special applications.

New highs in metal purity and cleanliness as well as new low cost methods of production are being sought by many metallurgists and engineers. Bonus in the search for substantially cleaner metals will be improved physical properties, extended fatigue life. Successful melting of limited amounts of alloy materials for special commercial applications already indicates these goals are well worth achieving.

Behind the drive for cleaner metals is the established experience of metallurgists. Metals free of nonmetallic inclusions and with accurately controlled compositions are physically superior products. Limited experience with "superclean" materials is proving their worth in special uses. Look for their production and use to grow rapidly.

### Better physical properties

What vacuum melting[1] may mean in improved physical characteristics is illustrated by the lengthened fatigue life and improved impact properties found in vacuum melted 52100. Extra metal cleanliness attained is an important factor in improved properties.

Carefully compared samples of regular and vacuum-melted 52100 showed a marked difference in fatigue life with the vacuum melted metal far in the lead.

Production vacuum melting furnaces can now turn out melts of 1200 lb of high purity copper and beryllium copper. Melts to 600 lb in steels and high temperature alloys are attained in production runs.

### Produce high temperature alloys

Industry interest in vacuum melting has brought demands for more flexible equipment. New units being developed in both Europe and America indicate a trend toward larger and more flexible furnaces in the future.

Commercial size specialty steel ingots will soon be produced in equipment being built by one steel company. The units will permit vacuum, inert atmosphere or reducing gas melting. First production will be high temperature alloys for jet engines. Tool and specialty steels will come later.

A double arc melting method has been developed to produce homegeneous titanium alloy ingots for experimental purposes. The method was used to replace pressed and sintered sponge electrodes formerly used. The initial ingot is forged into a rod which serves as the electrode in a second melting operation. While hardness pickup of 10 to 30 Bhn is experienced in double melting homogeneity is greatly improved. Ingots to 200 lb are possible in the pilot plant furnace at Armour Research Foundation.[2]

Progress is being made in melting of pure zirconium. The Atomic Energy Commission is the big user, the metal's high price limiting commercial uses. Several companies are working on new production methods.[3]

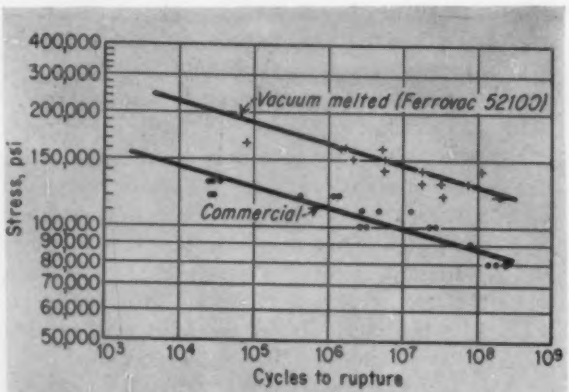
### Refined with oxygen

The oxygen steelmaking process has evoked wide interest. Rolled products made from oxygen steel are remarkably clean and ductile. The process uses a vessel similar to a Bessemer converter. To refine the steel a jet of high purity oxygen is directed at the surface of the bath at supersonic speed in a solid bottom converter. Technique produces a steel low in nitrogen, and with physical properties comparable with open-hearth steel.[4] A shop containing two 35-ton converters, oxygen plant and piping but not including the building itself will cost about $1.5 million. This plant would have annual capacity of about 300,000 tons.

Scrap can be carried in the charge to higher proportions than possible with conventional converter processes. Development of the process for large scale production was carried out in two Austrian steel plants. The two melting shops built each have a capacity of 150,000 metric tons. A converter lining is good for about 200 heats. Blowing period is about 18 minutes.

THE IRON AGE REFERENCES

1. Vacuum Melting Lengthens Fatigue Life, Improves Impact Properties, Apr. 2, 1953, p. 154.
2. Double Melting Produces Homogeneous Titanium Alloys, Aug. 6, 1953, p. 146.
3. Zirconium: Industry Taking Over, Sept. 3, 1953, p. 61.
4. Oxygen Steelmaking Yields High-Quality Product, Sept. 24, 1953, p. 127.




**FATIGUE LIFE difference between vacuum melted and commercial 52100 was found in tests with rotating beam machine. In terms of stress this means about a 50 pct increase at the same life for the vacuum melted metal.**

# WELDING

**Resistance welding beryllium copper alloys . . . Silver brazing alloys for type 430 . . . Improved techniques . . .**

New techniques, improved filler metals, more and better automatic equipment, simpler and stronger design, and many other factors contributed much to the art of welding during 1953. These developments have resulted in higher production rates, lower costs and more serviceable assemblies. Equally important were the advancements made by researchers whose efforts solved many problems regarding the behavior of metals under welding conditions.

One of these studies[1] shows that removal of weld reinforcement seems to be desirable when a weldment is subjected to severe biaxial loading. In a series of explosion tests over a wide temperature range and under combined load, related data pointed to the greater restraint introduced by the increased cross-section of high-strength weld metal as a possible cause for base-metal failures. Also, the transition from ductile to brittle behavior in reinforced welds occurs at much higher temperatures than in finish-machined weldments.

### Study weldability of titanium

Studies continued in an effort to evaluate the merits of argon and helium, and mixtures of these gasses, as protective envelopes when used for inert gas shielded-arc welding. At atmospheric pressure, these gases were tested for their possible effect on a direct-current arc, using tungsten electrodes in a range of 10 to 100 amp. In a mixture of the two gases, argon showed greater effect on the arc than helium, and as long as 15 pct or more of the mixture consisted of argon, arc properties resembled those of an arc in pure argon more than one in helium. The arc is stable in either gas if the gas system is free of oxide impurities.

Resistance welding of a beryllium-copper alloy has been done successfully.[2] This development greatly increased the potential use of beryllium copper. Two important properties, conductivity and resiliency, undergo absolutely no change when this material is spot welded in a particular condenser-discharge type welder. Ordinarily, welding heat would destroy the mechanical properties.

Thoriated tungsten electrodes, used in inert gas-shielded arcwelding, were under investigation with respect to their effects on the health of operators. Thorium oxide, present in small quantity, has given tungsten electrodes longer life and better performance. The natural radioactivity of thorium oxide presented the possibility of a hazard. Tests under adverse welding conditions showed that although radioactive thoria is released from the arc, the concentration in the operator's breathing zone is far below the allowable limits.

Titanium, one of the newer commercial metals, received much attention, particularly with respect to its weldability. Welds with tensile strengths of 150,000 psi have been made quite easily. Welding procedures have been developed to a point where entirely satisfactory welds can be produced in some titanium alloys.

Type 430 stainless steel has shown excellent corrosion resistance to many environments, but it would corrode when silver brazed with certain alloys and exposed to even mild tap water or a humid atmosphere.[3] Corrosion took the form of a red line of rust at the edge of the brazing alloy. This phenomenon is believed to be caused by ferrous ions going into solution within the crevice, migrating to the mouth of the crevice and forming ferric hydroxide. It then precipitates as red rust.

### Develop new silver-brazing alloys

As a result of this study, two new silver-brazing alloys completely resistant to tap-water corrosion, were developed for Type 430 stainless. Prevention of corrosion depends on a nickel-rich layer which these alloys provide over the area covered by the brazing alloy.

Out of the laboratory came a series of noncorrosive fluxes which have improved soldering operations on aluminum and other metals.[4] Besides being noncorrosive, these fluxes leave no residue, remove oxides and other interferring films very effectively, and have twice the solder-spreading action of zinc chloride on copper. They depend for their unusual action on hydrazine, a war-born chemical used as a rocket fuel.

### How to spot weld molybdenum

Among the numerous patents issued during 1953, one relates to the welding of two end-abutting bars. A thin metal link placed between the abutting ends and connected to an electric power source fuses the link between the bars. The link is reduced in cross-section so that an area of high electrical resistance is set up between the ends of the bars.

A method for spot welding molybdenum was also described in a patent. It involves the deposition of a flux containing powdered molybdenum and nickel on the surfaces to be joined. After the flux is applied, the parts are heated to 950° to 1150°F in a furnace, then resistance spot welded.

Use of a fuel from the hydrogen and hydrocarbon group of gases is involved in another patent relating to a new method of gas welding or cutting. In this method, fuel combustion is supported by chlorine fluoride in large enough quantity to increase the flame temperature.

A method and apparatus for brazing aluminum fins to steel tubes were also among the patented

developments. The method consists of fluxing the surfaces to be joined, placing the fins on the tube and applying the brazing material. A gaseous atmosphere approaching the brazing temperature surrounds the tube. Simultaneously, a fluid heated to the brazing temperature is circulated through the tube.

Among the new materials developed during the year are a number of soldering, brazing and welding fluxes. One of these is basically a lead-tin solder premixed with a specially compounded flux in paste form which can be applied easily by brushing or dipping. Another is a universal soldering flux applicable to all commonly used metals. It can also be used for aluminum alloys except those having high silicon content. This flux has no corrosive action on aluminum.

Another soldering flux, developed for stainless steel, Monel, Inconel, molybdenum and many other alloys, removes tough oxide films and promotes the flow of solder at low temperatures. A series of alloy paste solders were also developed for joining electronic connections. This series covers Federal specifications MIL-S-6872, AN-S-62 and MIL-E-5400.

Among the brazing fluxes is one for universal application with silver solders on ferrous as well as nonferrous metals. It is a mixture of fluoride and borate salts. Another brazing flux overcomes the objections of toxic fumes and can be used for brazing, silver soldering and hard soldering operations.

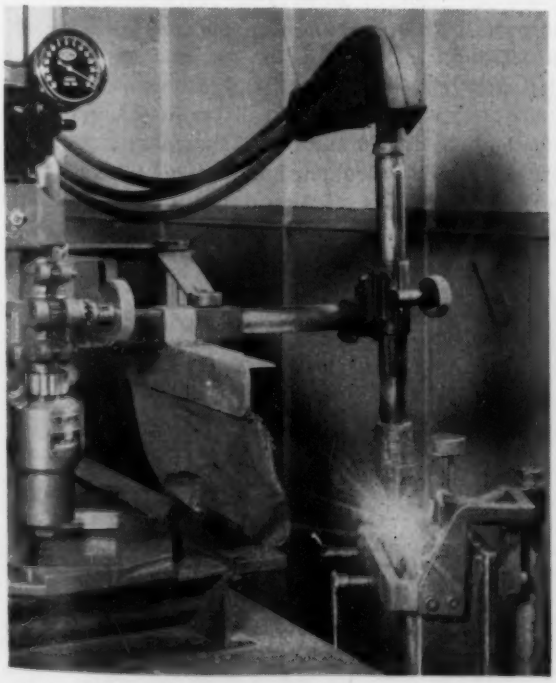
A jig for inert gas-shielded arcwelding of bombs, fire extinguishers, tubing and other similar shapes received attention from manufacturers. It consists of a pneumatic clamping device, a motor-driven welding head carriage and the necessary welding equipment. Carriage speed is adjustable within the range of 4 to 60 ipm.

In the field of apparatus for submerged-arc-welding is a machine for feeding two small-diameter electrodes simultaneously through one head and one contact jaw. The two electrodes replace one single electrode of larger diameter and increase welding speed by 50 pct and more. Use of higher currents permits greater rod deposition rates and deeper penetration. The feed rate of both electrodes is controlled automatically.

Many other developments, too numerous to mention, have contributed equally in the joining of metals. Some research programs started in 1953 are being carried through to completion in 1954. Better weldments of alloy steels are anticipated as the use of low-hydrogen electrodes grows. Great strides have already been made in developing techniques and filler metals for joining alloys used in high-temperature applications. In this field, new developments can be expected to keep pace with the extended use of these alloys.

THE IRON AGE REFERENCES


1. Flush Welds Withstand Impact Better Than Reinforced Welds, June 25, p. 136.
2. Beryllium Copper Spot Welded Without Change in Properties, Mar. 12, p. 142.
3. New Alloys Stop Corrosion in Silver-Brazed Type 430 Joints, Dec. 10, p. 159.
4. Improve Your Soldering With Noncorrosive Flux, Sept. 3, p. 115.

MAGNETIC TRACER guides torch around edges of an aluminum box being welded automatically by inert gas-shielded tungsten arm process. Welding speed is shown on tachometer.

SUBMERGED-ARC WELDING machine produces 2½ miles welded 30-in. diam pipe daily. Unfused melt is picked up by the vacuum tube, then recirculated through system.

# CASTING

**Foundries improve handling methods . . . More automatic controls . . . Shell molding shows continued growth.**

New lines were drawn in the old battle for lower production costs and improved foundry operation in 1953. Efforts of the foundry industry to trim costs are reflected in wider use of materials handling methods and automatic controls, demand for improved foundry machinery, and development of new production methods. As new, bigger and more modern foundries are built more engineering thought is being given to application of sound work and material flow principles.

Paralleling wider use of improved automatic equipment in the foundry, is the development and use of auxiliary control equipment. Sand can be more closely controlled with automatic equipment. In addition to controlling moisture content, instruments are being used to direct all sand mixing operations, for cycle timing, to control addition of bonding ingredients, and to control distribution of sand.

### Shell mold study continues

Ever since the government brought back the story of the Croning process from Germany, industry has watched, sampled and tested a production method which promised lower costs, greater freedom in foundry operation, and a superior product both as to surface finish and size tolerances.

As more foundries have tried shell molding it has become obvious the Croning process is not a cureall for foundry problems. But the advantages of pouring in a shell[1] are widely accepted. Both the newly developed Dietert process, still to be proved on a production basis, and the established frozen mercury process used in precision investment castings use a "shell mold." Evaluation of shell molding now centers about finding the best method of producing a shell at a reasonable cost.

There's plenty of quiet research in shell molding going on. Industry generally, after a first flush of enthusiasm, is reappraising the method on the basis of operating experience. There's plenty of "no comment" on the claim of Polygram Casting Co., Ltd., England, to patent rights.[2]

About 250 foundries are using the "C" shell mold process. But most of the industry has been hesitantly looking in the door. Completely automatic shell molding equipment is expensive. Most foundries, with substantial investments in existing equipment, are loathe to invest large sums of money in a process which requires, even at this date, much proving out in pilot plant production.

Resin costs have come in for considerable discussion in evaluating the shell mold process as compared with established foundry methods. Since resin makes up about 5 pct of the sand-resin mix, it figures as a continuing cost of production. The thermosetting resin cannot be reclaimed once used. Therefore resin figures as a continuing cost item in the production of shell molds.

Production of phenolic resins to meet fast growing demand from foundries will reach 50 million lb by 1957 one producer estimates. Production of shell mold process resins has doubled each year since 1950.

One educated guess estimates industry production of resin for shell molding was 8 to 10 million lb for 1953. One major producer put the going price of resin in 1953 at 28¢ per lb as compared with 32½¢ per lb in 1952. Resin production facilities are adequate and producers are optimistic about their ability to supply foundrymen with resin at a cost which will help make shell molding more competitive with other foundry production methods.

### Get more from resins

Resin makers, well aware of the cost problem, are seeking ways for foundrymen to get more molds per dollar spent on resin. Some believe phenolic resin requirements per mold will eventually be cut to 2 to 3 pct. They've found some types of sand may require more resin than others. To offset this problem, a variety of resin formulations are offered to produce the most efficient resin-sand mix. More new resin formulations to permit greater resin economy may be expected in 1954.

Some resin producers suggest more efficient utilization of resin may be achieved by: (1) thermal coating of sand with thermosetting binders; (2) use of alcoholic solutions of conventional binders; (3) use of liquid phenolic resins for sand coatings. Foundrymen are combining com-

**MAKERS OF SHELL MOLD RESINS**

Acme Resin Co., Forest Park, Ill.
American Cyanamid Co., N. Y.
Bakelite Co., Div. of Union Carbide & Carbon Corp., N. Y.
Barrett Div., Allied Chemical & Dye Corp., N. Y.
Borden Co., Chemical Div., N. Y.
Catalin Corp. of America, N. Y.
Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.
Monsanto Chemical Co., Plastics Div., Springfield, Mass.
Reichold Chemicals, Inc., Detroit, Mich.
Schenectady Varnish Co., Schenectady, N. Y.

mercial binders to reduce curing time, improve porosity, get better removal when stripping cured shell molds from the die face.

One outstanding aspect of the development of shell molding machinery has been that newcomers to the field of foundry equipment have led the way. Old line equipment makers have given plenty of thought to the future of shell molding, and the type of equipment which will best meet industry needs. Some have set up lines of equipment and more are expected to enter the field. Reports indicate some producers who have ventured into the shell mold equipment field already have substantial backlogs.

Look for more low-cost automatic and semi-automatic shell mold making machines in the future. These smaller machines aim at helping the foundry get going in shell mold production. They have one thing in common, they aim to make the cost of automatic and semi-automatic shell mold making machinery more attractive to the average foundry.

Competition for the Croning process may come from the Dietert process. Using standard foundry equipment to produce a shell, the process aims at meeting some objections to the Croning process, while retaining its advantages. A reconstructed core oil is used as a binder. With this oil a shell equal in strength and hardness can be produced at about one third the cost of a resin shell. Conventional foundry equipment is used to make the shell. Pattern equipment works cold and is easier to build to a definite dimension. Only about a third as much binder is used as with the Croning process and cost for pattern equipment is lower. Odor problems linked with use of phenolic binders, are considerably reduced.

A new high-carbon coke promises to be of major importance to the foundry industry.[3] Higher carbon pickup in foundry iron with half the fuel has been claimed possible. Use of more low grade scrap and less pig iron in the cupola would permit further economies in foundry operation.

Still biggest news in diecasting is industry's increasing acceptance of diecast products. Estimated sales by job shops are expected to top $300 million for the first time. This compares with $244.5 million sales for 1952.

Prime factor in growth of the industry has been the increasing familiarization of both engineers and production men with diecasting design requirements and methods of production.

Automakers, aircraft, and appliance manufacturers continue as big users. Fast spreading use of automatic transmissions, and ability of diecasters to produce the parts needed, have stimulated production.

## CONTINUOUS CASTING MACHINES

### OPERATING, INSTALLED OR PLANNED

| | |
|---|---|
| **Rossi-Junghans** | |
| American Metal Co. (1) | Copper |
| Bridgeport Brass Co. (3) | Brass |
| Scovill Mfg. Co. (2) | Brass |
| Allegheny Ludlum Steel Corp. (1) | Steel |
| James Booth, Ltd., England (1) | Aluminum |
| James Booth, Ltd., England (1) | Brass |
| Imperial Chemical Industries, Ltd., England (1) | Aluminum |
| Atlas Steel, Canada (1) | Steel |
| Louvril, France (1) | Steel |
| United Steels, Ltd., England (1) | Steel |
| Edstrand Bros., Sweden (1) | Steel |
| Marine et Homicourt, France | Steel |
| Sumitomo Metal Industries, Ltd., Japan (1) | Steel |
| Japan Special Steel Co., Japan (1) | Steel |
| Invest-Import, Yugoslavia (1) | Copper |
| **Properzi** | |
| Nichols Wire & Aluminum Co. (1) | Aluminum |
| Anaconda Wire & Cable Co. (2) | Aluminum |
| General Cable Corp. (1) | Aluminum |
| Rome Cable Corp. (1) | Aluminum |
| Southwire Co. (1) | Aluminum |
| Essex Wire Corp. (1) | Aluminum |
| Aluminum Co. of America (1) | Aluminum |
| **Hazelett** | |
| Armco Steel Corp. (1) | Steel |
| Olin Industries Inc. (1) | Aluminum |
| Dow Chemical Co. (1) | Magnesium |
| **Others** | |
| Hunter Douglas Corp. (1) | Aluminum |
| Babcock & Wilcox—Republic Steel (1) | Steel |
| Apex Metal Products Corp. (1) | Aluminum |
| American Smelting & Refining Co. (4) | Copper |
| American Smelting & Refining Co. (1) | Precious Metals |
| American Smelting & Refining Co. (6) | Copper-Tin-Lead-Zinc Alloys |

### THE IRON AGE REFERENCES


1. Complex Aluminum Part Successfully Shell Molded, July 23, 1953, p. 124.
2. British Claim Patent Rights For Shell Molding, Jan. 15, 1953, p. 99.
3. How to Improve Carbon Pickup In Foundry Iron, July 16, 1952, p. 140.


## MAKERS OF SHELL MOLD EQUIPMENT OR COMPONENTS

Dachner Die Mold & Machine Corp., Franklin Park, Ill.
Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago
Econocast, Inc., Chattanooga, Tenn.
Mechanical Handling Systems, Inc., Detroit
Metco Processing Corp., Ypsilanti, Mich.
(Custom Built machines only)
Polygram Canada, Ltd., Toronto, Canada
Shalco Engineering Corp., Palo Alto, Calif.
Shallway Corp., Connellsville, Pa.
Shell Mold & Machine Co., Yonkers, N. Y.
Shell-O-Matic, Inc., Newark, N. J.
Shell Process, Chicopee, Mass.
Southern Shell Mold Equipment Co., Chattanooga, Tenn.
Sutter Products Co., Dearborn, Mich.
Tyler Metal Products, St. Louis
Edwin L. Wiegand Co., Pittsburgh

# TESTING AND INSPECTION

**New equipment and methods lower inspection costs . . . Nondestructive testing gains wider application . . .**

Industry's vigorous demands for better products have put increasing emphasis on testing and inspection methods. The answer to these demands are reflected in the steady growth of improved methods of measurements, of new testing equipment, and in the wider application of statistical quality control.

There's a steady trend toward development and use of improved testing methods and equipment. Two objectives are sought: (1) Reduction of labor in the inspection operation, and (2) speed-up in testing methods.

Watch for wider application in testing of automated and fast cycle methods of operation which characterize modern manufacturing operations. Typifying this trend is the use of a new automatic pipe tester at one steel plant.[1] From 20 to 30 pct less man power was needed to operate a fully automatic pipe testing unit. Formerly hydrostatic testing was done on a manually operated machine. Testing on the new machine has been cut to seconds. Maximum production is 1500 pieces per 8-hr turn.

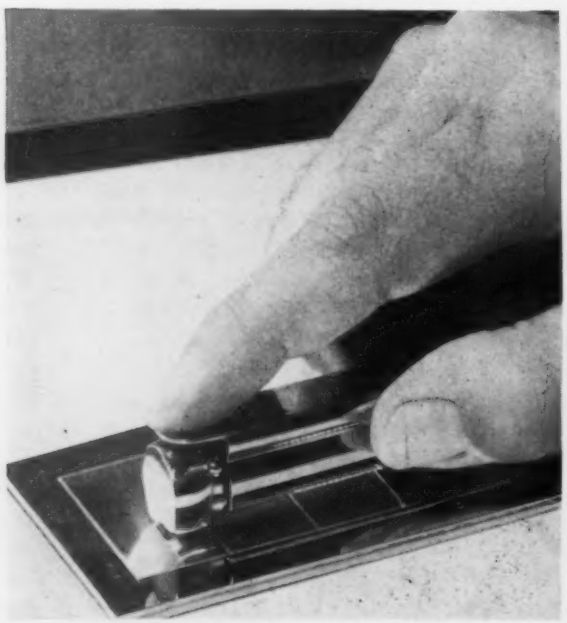
Typical of the approach to solutions of manufacturing problems involving part quality is the application of high speed motion pictures[2] to analysis of machine malfunctioning. Minor malfunctioning of high speed machinery, when a cause of poor quality in mass produced parts, is often difficult to detect. But with high speed motion pictures, malfunctioning of a cam, spring or other small part normally undetectable can quickly be located.

Greater use of the direct reading spectrometer is assured for the future and will not be limited to strictly manufacturing operations. One company has speeded the stocking and acceptance of metals in its warehouse through use of this testing machine. The machine analyses metal samples and provides almost instantaneous readings on the percentage of each element in the metal. It has replaced time consuming wet methods of chemical analysis.

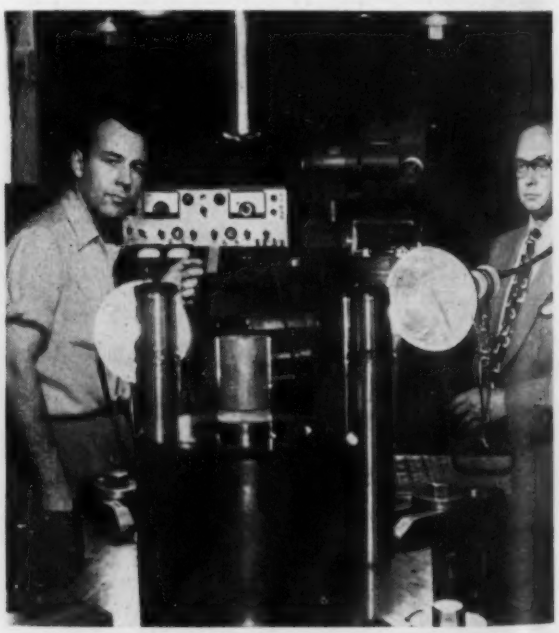
Of major importance is the continued development of improved methods of nondestructive testing. Wider use of radioactive isotopes, improved small X-ray machines, and new approaches to ultrasonic testing methods promise to have considerable impact.

An important influence in the extended use of radioactive isotopes for inspection has been lower cost. Latest figures from the Atomic Energy Commission indicate about 700 shipments are being made annually. One manufacturer is now offering a complete cobalt 60 inspection package for less than $800. This includes a source, cast iron shipping and storage container, remote handling probe, and other equipment.

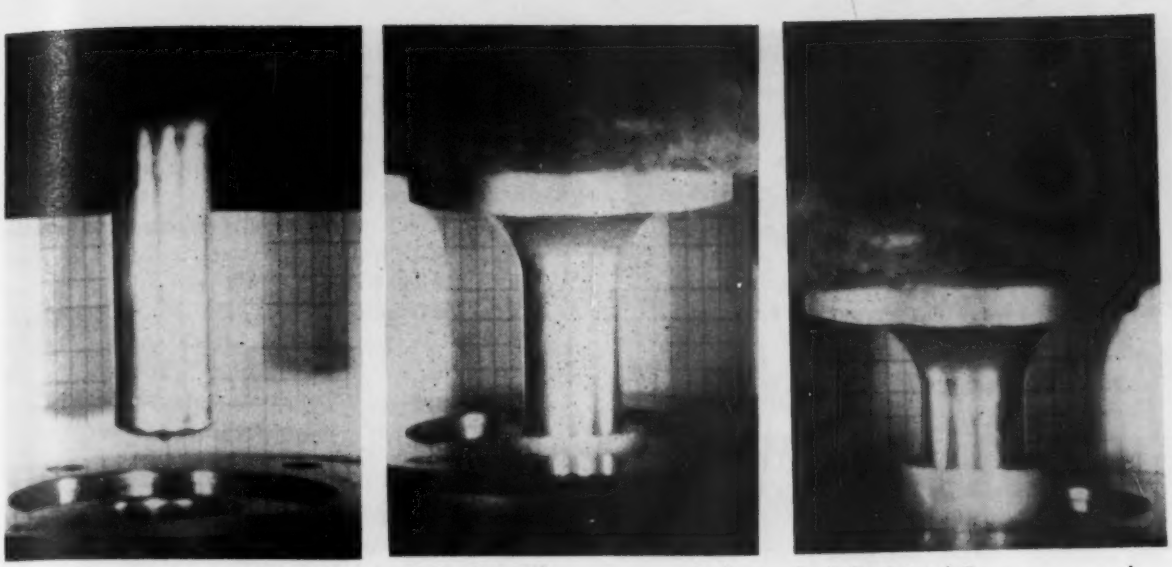
Cesium 137 is being used successfully for parts inspection.[3] A 33-year half life promises to give it wider use as an inspection tool for com-



PRECISION REFERENCE specimens used to calibrate surface roughness measuring instruments were developed by GM and Chrysler.



IMPERFECT PARTS led to this fast film study of die used to make impact extrusion parts at Lockheed Aircraft Corp., Burbank, Calif.



**TOO MUCH SLACK in plunger and die showed up when impact extrusion operation was studied with high speed motion pictures. Slug is in die as punch descends, left. Metal flows up around punch, center and right, as the punch progresses downward against the slug.**

panies doing a limited amount of work. It has an intermediate energy level and bridges the gap between iridium 192 and cobalt 60. It is suitable for materials of intermediate thickness and density. Since it is a fission product, it should be more readily available in the future.

More accurate measurements of carbon penetration in case-hardened steels is now possible with a technique using carbon 14. Radioactive carbon 14 is chemically like normal carbon 12. Mixed together and used in case hardening, they behave the same with one important exception. Carbon 14 beta rays signal the location of carbon in the steel. When the steel is held in contact with X-ray film, radiations produce a picture pattern of carbon distribution.

Of importance to all plants making parts where finish is measured, is the plan of the American Standard Association to simplify surface roughness measurements.[4] Use of arithmetic average microinch readings for surface roughness measurements are recommended in a proposed revision ASA B 46 1953. The revision, representing a step toward greater accuracy, would replace root mean square microinch values. Much of industry and the military are planning to make the switch in accordance with the proposed revision.

New methods and applications of ultrasonic testing are being developed rapidly. A method has been successfully devised to locate flaws in small diameter tubing.[5] A high frequency pulsating sound wave is sent into the tubing to locate flaws by reflecting from the defect. The reflected sound waves go back to a searching unit which presents them on a reflectoscope.

Use of a liquid coupling is a further development in ultrasonic testing. Designed to replace piezoelectric materials, it combines the advantages of contact and immersion test methods. Crystal wear is practically eliminated. Defects 0.125 in. below the surface of aluminum can be detected. One of the new scientific instruments, developed to pace the rapidly growing needs of metal techniques, is the emission spectrograph.[6] It has been used successfully to meet expanding analytical requirements of titanium, beryllium, zirconium and uranium.

Of interest to plants handling powdered materials, such as pigments, metal powders, abrasives and ceramics, is the Micromerograph particle size distribution analyzer. One person can analyze billions of particles in 15 minutes with a probable error of only ±3 pct.

Two interesting devices have been developed for routine on-the-job testing. One tests the drawability of steels and has attracted wide attention. It offers a simple quick nondestructive and accurate testing method. Checking the drawability of sheet steel before stamping by this method has many advantages over tests previously used. Paint thickness may be measured quickly and accurately with an instrument no bigger than a man's hand. Accurate measurement within 0.0003 in. are made in any location where the thickness of the metal remains constant. The instrument depends on measurement of a flow of current.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1. Automatic Pipe Tester Cuts Inspection Costs, Jan. 8, 1953, p. 105.
2. Cut Engineering Costs With High Speed Motion Pictures, Aug. 27, 1953, p. 97.
3. Cesium Radio Isotopes . . . New Tool For Parts Inspection, Sept. 10, 1953, p. 174.
4. ASA Will Simplify Surface Roughness Measurements, Dec. 3, 1953, p. 180.
5. Ultrasonic Testing Used For Small Diameter Tubing, Jan. 29, 1953, p. 110.
6. Spectrochemical Techniques Advance Titanium Technology, Sept. 17, 1953, p. 166.

# FORGING

**Conveyors help forge plant efficiency . . . impact forging experience grows . . . trend is to standard forging billets.**

Increased use of forging presses, automatic handling from the billet stage to the finished part, and the use of shot blasting to clean forgings were top topics of conversation in the forging industry during the past year. All-cast refractories and fast heating of forgings were among the significant technical developments.

During the past year, a big split-die, multiple-ram forging press was placed in operation at the Cameron Iron Works in Houston, Texas. This 11,000-ton giant is 60 ft high and weighs 3,100,000 lb.[1] Ordnance Dept. will have some call on the press for breech rings, but its primary output will be oil country goods or other forgings to withstand high temperatures and pressures.

There have been some cutbacks in the original Air Force program, announced a couple of years ago, to provide 17 huge forging and extrusion presses for more efficient aircraft production.[2, 3]

The revamped schedule now calls for six extrusion presses ranging from 8,000 to 13,200 tons capacity, and four forging presses, two of 35,000 tons and two of 50,000 tons capacity.

## Conveyors boost productivity

Reduction of the number of presses on order does not diminish the importance of the equipment in the eyes of the Defense Dept., Air Force planners and aircraft manufacturers. Merit of the project is unquestionably accepted although a review at top planning levels indicated the number of units originally ordered would put capacity in excess of requirements.

Forging manufacturers are looking closely at the conveyors in their plants as a means of improving plant efficiency. When efficient conveyors are carefully integrated with modern press equipment, important gains both in quantity and quality of the product may be forthcoming.[4]

Impact forging experience is piling up in numerous production applications using both ferrous and nonferrous metals. The process offers faster production, less waste, and greater economy in the manufacture of shapes that are difficult to fabricate by other methods.

On long production runs impact forging has demonstrated greater overall economy in the fabrication of shell cases, boxes, symmetrical containers and deep drawn parts.[5] The process pays off on lower quantities, too, where more complicated shapes involve unsymmetrical designs.

Impact forging generally creates the improvement in mechanical properties and refined grain flow associated with all forging operation. In low carbon and alloy steels the limits of size and percentage of reduction of extruded detail are considerably less than is the case with nonferrous metals.[6] Preheating the steel slugs or billets has been helpful, and proper application of an adequate lubricant is a major prerequisite.

Two automobile plants have been experimenting with the use of impact forging for the production of jet engine blades. The results are promising enough to encourage further study, but as yet there has been no quantity production.

## Shot-blast vs. acid cleaning

The use of acid for cleaning forgings has always been a costly and troublesome operation. With increased interest being shown in stream pollution control, the application of short-blast cleaning methods has received deserved attention from forging manufacturers.

For a number of years the automobile industry has been using large quantities of partially formed billets in its forging operations. Rolled-to-shape blanks simplified the forging process and, where the volume of production was sufficiently large to justify the manufacture of special billet-shaping rolls, this was considered to be an economical procedure.

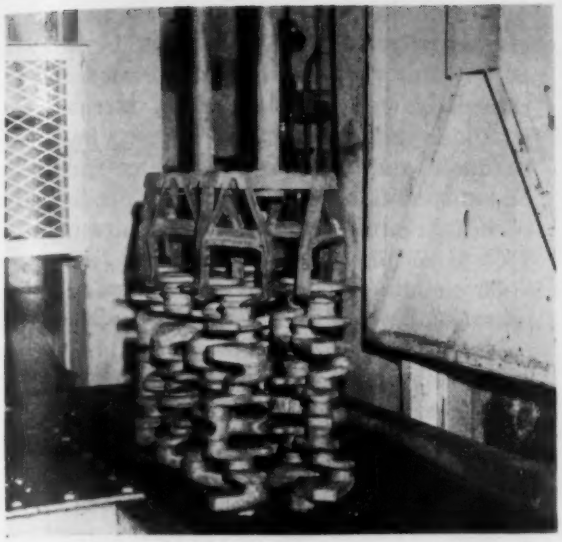
The trend at the moment in automotive plants seems to be toward the use of standard billets on which all shaping is done in the automotive forge shop.

There is an interesting struggle taking place in Detroit on the question of whether automobile crankshafts will eventually be made by forging or by the comparatively new shell molding process. Exponents of the traditional forging method argue, for example, that where the forge plant is modern and fully mechanized, there is at present small advantage, if any, in favor of a shell-molded crankshaft from the standpoint of possible increased production. This group also claims that from the quality point of view, the advantage is strongly on the side of the forged crankshaft.

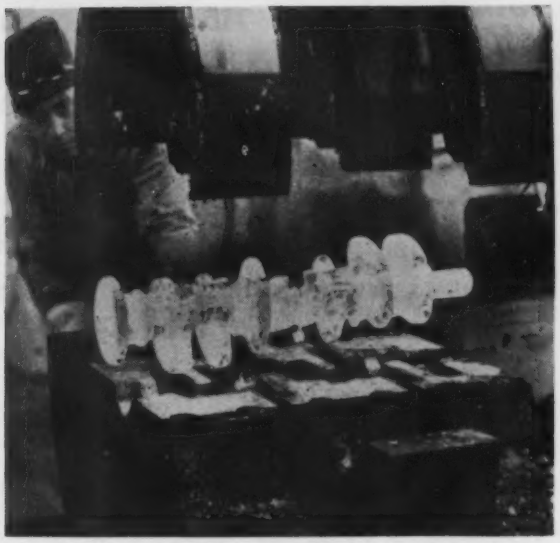
Up to the present time Ford, which has always used a cast crankshaft, is the only producer to adopt the shell-molding technique to its foundry production of these parts. However, there is no denying that General Motors is making an extensive investigation of the process.


THE IRON AGE REFERENCES

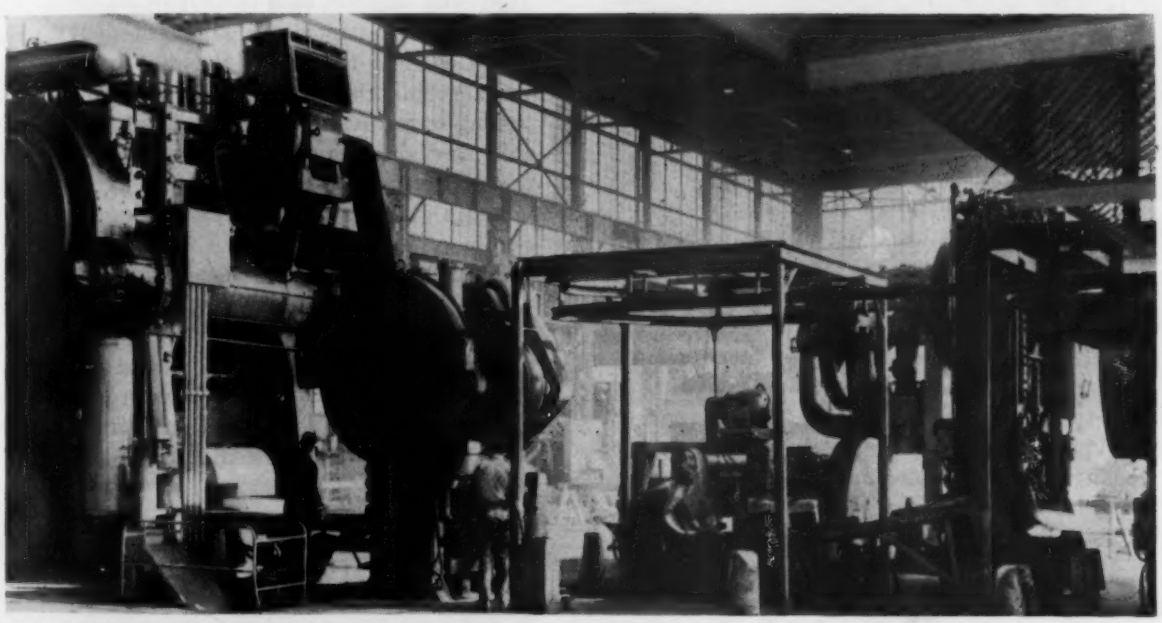
1. Big Split Die Press Starts Up in Cameron Iron Works, June 25, 1953, p. 73.
2. Heavy Presses, The Iron Age, May 7, 1953, p. 151.
3. Heavy Presses Still Important, June 25, 1953, p. 78.
4. Conveyors, Integrated Presses Help Boost Shell Output, Feb. 5, 1953, p. 166.
5. Use Impact Forging For Tough-To-Machine Parts, April 2, 1953, p. 149.
6. Impact Forging Can Save You Money, April 2, 1953, p. 153.



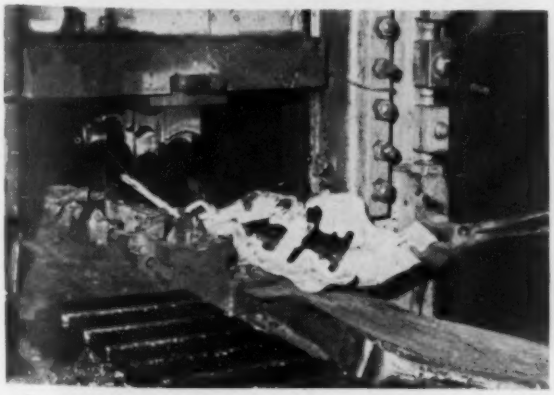
Nearing the end of Dodge's automated crankshaft production line, these forgings are being quenched for 70 sec in agitated water. A cleaning, balancing and inspection follow.



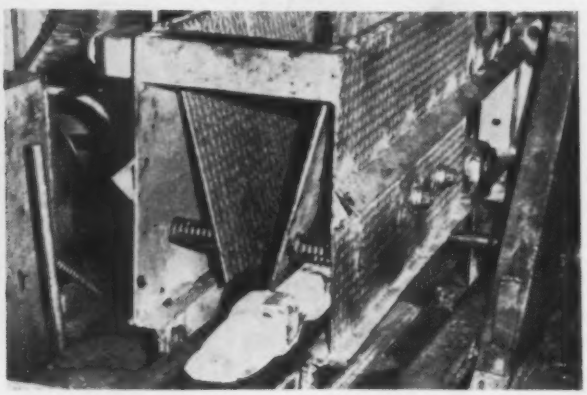
Dodge V-8 crankshafts, trimmed but flat, move to this machine where they are twisted for proper alignment of crankpin bearings before starting the automatic heat treating cycle.



This 6000-ton high speed mechanical forging press is a feature of the new, automated, crankshaft press shop at the Dodge Forge Plant. Reduced billets are forged flat, twisted later.



Crankshaft scrap from this trimming press is placed on the slide shown. Dropping through a floor opening to another conveyor, the scrap is carried to storage or to railroad cars.



Automatically conveyed through prior shearing, heating, de-scaling and reducing operations, this reduced crankshaft billet is ready for flat forging on a 6000-ton mechanical press.

# METAL FINISHING

**Improved methods, formulas industry objective . . . Try new cleaning processes . . . New uses for porcelain . . .**

New formulas, techniques and equipment aroused a great deal of interest among metal finishers during 1953. The developments moved the industry ahead another big step toward faster production of better and longer-lasting finishes. What was once an art, and might yet be considered as such, is rapidly becoming a science.

Gold-plated surfaces for industrial and commercial applications have become practical with a process[1] which cuts costs, improves quality and provides longer life for many products. Coatings are bright, smooth and hard, requiring no brushing, polishing or buffing. Cathode efficiency is 100 pct and deposits of 0.001 in. and thicker can be made regardless of size or shape of the product being plated.

In an initial production test, a new bright-nickel process has reduced costs, increased output and produced brighter finishes with an easy-to-control bath[2]. This bath has broad operating ranges for temperature and current density. The bath also has good leveling properties so that no buffing before plating is necessary. Good ductility and low internal stress in the deposit have eliminated cracking, crazing, peeling and pitting. High tolerance for impurities and use of stable brightening agents are among the desirable features of this bath.

### Plating methods improved

Iron plating from an alkaline bath has been used for steel gun parts which are subsequently assembled by brazing. Heretofore, iron plating has been done primarily from acid solutions. This bath consists essentially of high ferric ion concentration, with sodium hydroxide, triethanolamine, plus the sodium salt of ethylenediamine tetra-acetic acid. Although the throwing power of this bath is good, it is extremely sensitive to temperature. At the present time, commercial use of this bath is limited but it offers some advantages over acid solutions.

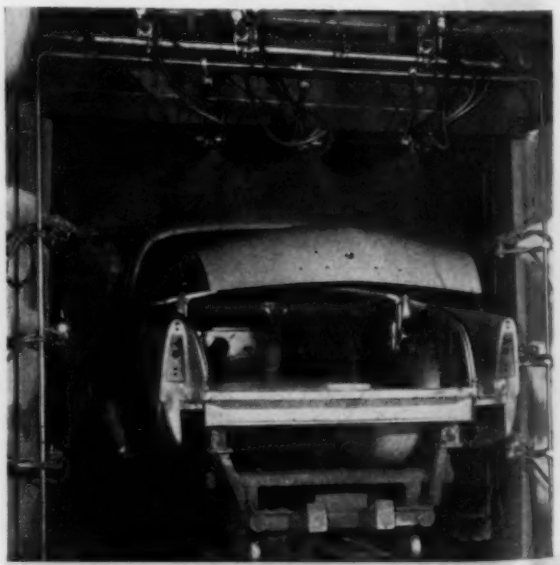
Nickel plating by chemical reduction[3] has been controlled to produce hard, adherent deposits on a variety of metals. The process requires no electric power or anodes, and consequently presents no problems in throwing power. Uniform deposition, both internally and externally, can be obtained on intricate and irregular shapes. Although deposits have good hardness and corrosion resistance in the as-plated condition, these properties are improved by heat treatment in the temperature range of 700° to 950°F.

Chromium deposits have been used for many years as decorative finishes, or because they provided good wearing properties.. In either case, the chromium itself resists corrosion but when cracks or pores develop, the protection offered by the chromium in corrosive surroundings is not much better than that of the underlying metal.

### Process uses chromic acid baths

To answer this problem, a new process using special chromic acid baths was developed. Deposits produced by this process remain crack-free even when heated to 1000°F whereas ordinary chrome deposits cracked at 300°F. The finish is dull to semibright, but being somewhat softer than conventional chrome plate, buffing or polishing to a high finish is no problem. In salt spray tests, these deposits lasted three to four times longer. They can also withstand higher external stresses than ordinary chrome plate.

Black chromium-base deposits having good adherence were obtained from three different solutions. One of these solutions, chromic acid containing nickel salts, produces a silvery finish which can be blackened by processing in hydrochloric acid. Two other baths produce black finishes without further treatment. These



**AUTO BODIES are sprayed with nine electrostatic guns at each end of booth at 90 per hr rate. One big feature is uniformity.**

baths operate in a temperature range of 86° to 130°F and at current densities of 695 to 1850 amp per sq ft. Deposits from these baths are both bright and hard.

In the field of cleaning and finishing, numerous developments and improvements have cut costs, provided better surfaces and increased production rates. Liquid honing of a 90-mm gun barrel, for example, takes only 45 min to prepare for chromium plating[4]. The liquid is a mixture of about 3 lb of silica grit in water. With pumping apparatus and special nozzles, this mixture is sprayed onto the surface being cleaned. Although maintenance on equipment has proved effective and efficient.

Mechanical cleaning was also put to good use on gray iron and bronze castings ranging in weight from 1 to 1000 lb. In this case, abrasive shot blasting effectively cleaned inside of deep recesses and holes. By this process, 6 tons of castings can be cleaned in less than 4 hr, and man-hour requirements have been reduced to less than 50 pct. Savings amounted to $4.35 per ton of metal cleaned.

### Better cleaning methods tried

New equipment and materials were introduced for virtually every cleaning method. Triangular ceramic pieces used in tumbling operations not only clean surfaces effectively, but because of their hardness, last many times longer than aluminum-oxide chips or other materials used for tumbling.

One patent tells of a polishing device with a flexible surface which holds an adherent layer of abrasive material. The abrasive consists of polyvinyl acetate, alkali-silicate, sodium carbomethylcellulose, clay and sorbitol.

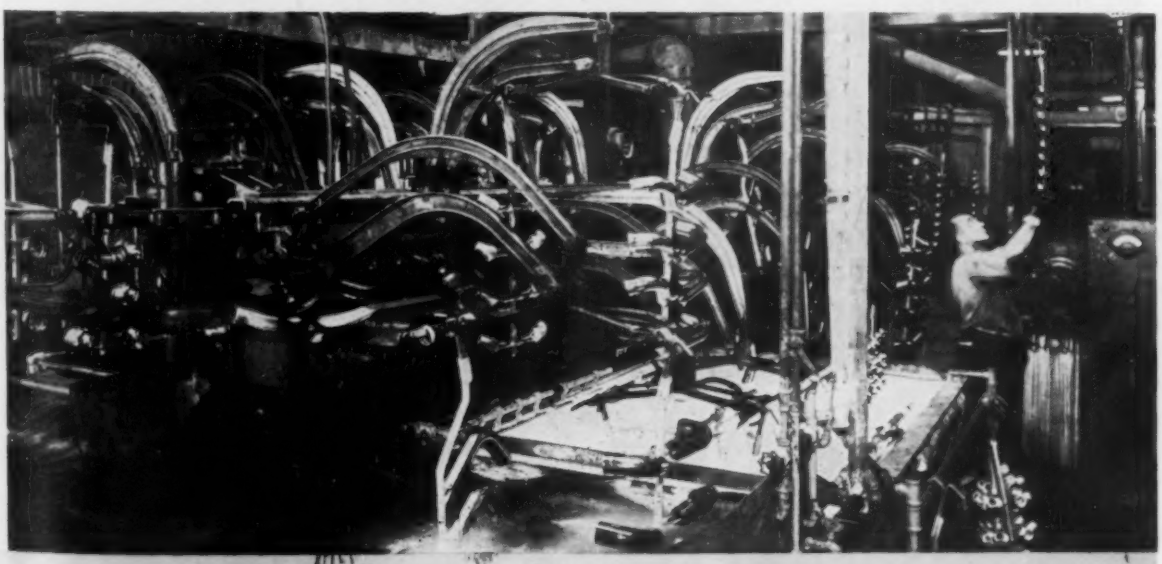
A new phosphating cleaner, applied in concentrated form, removes oils, greases and tars, and at the same time provides a rust inhibitive surface. Another patent describes a cellulose fiber material capable of absorbing eight times its own weight. When used in tumbling barrels, it effectively removes oils, greases and fats.

A method of high-temperature cleaning of ferrous metals was also among the patents issued. Surface oxides and carbonaceous matter are removed by exposing the metal to a temperature in the range of 670° to 1700°F in an atmosphere which contains one gas to oxidize carbon and another gas to deoxidize iron oxide. Thus, the carbonaceous matter and iron oxide are removed simultaneously.

There has been much activity in the field of protective coatings. Drum linings formulated from new epoxy resins offer unusual resistance to chemical attack[5]. These linings are nontoxic and withstand cracking, denting and scratching. With these and other protective coatings, drums can be reconditioned for reuse for a wider variety of products.

Cold-dip plastic coatings provide a simpler method of protecting parts in storage from corrosion. Hot-dip coatings required special melting pots, and excessive overheating usually causes deterioration of the material used. Strippable coatings from 1 to 60 mils thick can now be applied without preheating of parts. Protection is afforded by a plastisol which is a fluid dispersion of a vinyl resin to which stabilizers, rust inhibitors, colors and fillers have been added. The plastisol also carries special corrosion inhibitors.

Both hot and cold-dip plastisols have been



FULLY-AUTOMATIC plating equipment is becoming more commonplace in industry. It speeds operations and produces uniform quality plate. In this installation, brass plumbing fixtures are given a bright chrome finish. Thousands of parts are plated daily at minimum cost.

applied for many uses other than keeping parts in storage. For example, plastisol coatings are applied to plating barrels, tank frames and racks. Pipes lined with this material can carry many different types of corrosive agents. It is also used in circuit-breaker boxes and control boards because of its good insulating properties. Ability to use color identification makes plastisols particularly useful for wiring.

Among other patents issued during 1953, many were for new methods of metal finishing. Application of a thin adherent coating of titanium to a harder material is described in one of these patents. By projecting a spray of titanium pellets at an angle almost parallel to the surface being plated, surface deformation due to the force of the pellets is virtually nonexistent. However, maximum impact plating efficiency is secured at this angle.

Another patent deals with coating aluminum with an adherent deposit of tin. In this process, practically all the surface oxide is first removed from the aluminum. The aluminum is then immersed in a bath consisting of water, an organic addition agent, a water-soluble tin salt, and a water-soluble fluoride.

A bright dip for cadmium and zinc alloys imparts a colorless surface to the metal. The aqueous acidic solution consists of different amounts of chromic, sulfuric and acetic acids. Another patented solution for depositing smooth, bright chrome consists of an aqueous solution of chromic and sulfuric acids. Indium sulfate is added in the proportion of 14 to 16 parts per 100 parts of chromic acid. A few nickel plating solutions were among the patented items.

Unusual dipping equipment and a separate drying unit enabled the successful application of porcelain enamel coatings to long lengths of black steel pipe. Continuous fusion of the coating is accomplished by a special furnace. The pipe first receives a thorough sandblasting inside and out, after which a slip of wet enamel is applied to the metal base. Troughs holding the enamel slips for the ground and cover coats can handle pipe up to 21 ft long.

While new applications were sought for conventional porcelain enamels, a great deal of progress was made with the high-temperature coatings. Thus far, the bulk of work done along this line has been for aircraft applications. Some industries have already found good use for these coatings while other industries should benefit from the research and production practice gained in the aircraft program.

High-temperature porcelain coatings have much to offer to industry in general. Alloy steels, for example, can withstand temperature which ordinarily would make them useless. In other cases, alloy steels can be used in place of critical alloys.

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[1] New Plating Process Expands Industrial Use of Gold, June 25, p. 131.

[2] New Plating Process Deposits Nickel Brighter, Faster, Dec. 24, p. 78.

[3] Electroless Plating Produces Hard Nickel Coating, June 11, p. 115.

[4] Gun Barrels Deburred and Cleaned by Liquid Honing, Aug. 27, p. 102.

[5] New Resin Linings Give Better Container Protection, June 11, p. 129.


AUTOMATIC BUFFER finishes auto bumper which has been plated. Each buffing wheel is individually powered and is allowed to move as bumpers are conveyed through the machine.



# HANDBOOK OF TERMS

## *Commonly used in the Nonferrous Industries*

The Handbook of Steel Industry Terms published by The Iron Age, March 12, 1953, produced so much interest that this nonferrous glossary was prepared as a companion piece. The editors wish to thank the Aluminum Association and the Copper & Brass Research Association for permission to reprint from certain of their manuals. The section on magnesium was prepared for this handbook by Dow Chemical Co.

### Aluminum

Sheet & Plate, Extruded & Tubular Products*

**Angularity:** The conformity to, or deviation from, specified angular dimensions in the cross-section of a shape.

**Anodizing Sheet:** Sheet of suitable constitution and surface quality for the application of protective and decorative films by an anodic oxidation process.

**Bend Radius:** The distance from a center line or point to the axis of rotation, applied to the forming of a product by bending.

**Billet:** A solid semi-finished round or square product which has been hot worked by forging, rolling, or extrusion. See Extrusion Billet. (E & T)

**Blister:** A raised spot on the surface of the metal caused by expansion of gas in a subsurface zone during thermal treatment. See also, Core Blister, Coating Blister, and Bond Blister.

**Block Marks:** Short longitudinal-type scratches introduced during strip rolling, usually on the reeling equipment, by relative movement between adjacent wraps of the coil.

**Bloom:** A semi-finished hot rolled product rectangular or square in cross-section, produced on a blooming mill. (E & T)

**Bond Blister:** Blister which occurs at the interface between the coating and core in clad products. This type of blister is evident only on that surface of the sheet, shape or tube nearest the interface in question.

**Bow:** Longitudinal curvature.

**Brazed Tube:** Tube formed from sheet and fastened at the seams by brazing.

**Brazing Rod:** Rod (rolled, extruded, or cast) produced for use in joining metals by brazing.

**Brazing Sheet:** Non-clad or special clad sheet for brazing purposes with the surface of the special clad sheet having a lower melting point than the core. Brazing sheet of the clad type may be clad on either one or two surfaces.

**Broken Edges:** Edges containing cracks, splits, or tears. (S & P)

**Broken Surface:** Myriad, minute cracks on the surface of the sheet running normal to the rolling direction and perpendicular to the sheet surface. (S & P)

**Broken Surface:** Surface fracturing, generally most pronounced at sharp corners of extrusions, myriad, minute cracks on the surface of a drawn shape or tube normal to the direction of drawing. (E & T)

* Definitions applying specifically to one or the other of these two groups are followed by (S & P) or (E & T).

**Buckles:** A distortion as a bulge, wave, or twist causing the sheet to deviate from perfect flatness.

**Center Buckle:** Sheet having a buckled or wavy condition in the center with substantially flat edges is said to contain center buckle.

**Edge Buckle:** Sheet having a buckled, rippled, or wavy edge.

**Oil Can:** A sheet buckle which can be snapped from one position to another. Also referred to as a snap-buckle.

**Buffing:** A light polish by use of fine abrasives applied by cloth wheels running at high speed.

**Burr:** The thin edge or roughness left by sawing.

**Bus Bar:** A bus conductor of rectangular or square cross-section of any dimension. (E & T)

**Bus Conductor:** A rigid electrical conductor of any section; usually rectangular or square bar or tube, channels, or angles.

**Butt Seam Tube:** See Open Seam Tube.

**Butt Welded Tube:** A tube formed from sheet by placing one edge or end against the other and joining by welding.

**Caustic Stain:** A superficial etching of the surface by caustic.

**Center:** The difference in gauge between the center and edges of the sheet.

**Chatter:** An uneven surface on extrusions or drawn tubular products, usually formed by vibration of the metal during extrusion or drawing.

**Coating Blister:** Blister which occurs in the coating or liner of clad products. This type of blister is evident only on that surface of the sheet, shape or tube containing the blistered liner.

**Coating Streaks:** A streaked condition resulting from rolling on rolls containing bands of roll coating. In some instances where coating is heavy it may flake off onto the sheet surface and give a speckled condition known as roll coating pickup. (S & P)

**Coiled Roofing Sheet:** A standardized coiled sheet material of specific temper, width, and thickness intended for the manufacture of corrugated or V-crimp roofing.

**Coiled Sheet:** Coiled sheet is furnished in rolls (coils) with slit edges.

**Coiled Sheet Circles:** Coiled sheet cut into circular form.

**Commercial Tolerance:** This term is not recommended. The term "Standard Tolerance" is preferred. See also, Tolerance.

**Concavity:** A concave condition applicable to the width of any flat surface.

**Concentricity:** Adherence to a common center, as in the inner and outer wall of a tube.

**Condenser Tubes:** This term is frequently used in the broad sense synonymously with the term Heat Exchanger Tubes. The term Heat Exchanger Tubes is preferred, unless specific reference to a Condenser is intended.

**Conduit:** A tube used to protect electrical wiring. See Rigid Conduit and Electrical Metallic Tubing.

**Conveyor Marks:** Scratches and pits caused on one side of the sheet by contact with cables or other means of conveyance through furnace during conveyor annealing.

**Core Blister:** Blister which occurs in the core of clad products.

**Cross Hatch:** Light broken surface. See also, Broken Surface.

**Die Line:** A longitudinal line or scratch resulting from the use of a roughened tool or the drag of a foreign particle between tool and product.

**Die Number:** The number assigned to a die for identification and cataloging purposes, usually the same number that is assigned for the same purpose to the product made from that die.

**Diffusion Streaks:** Brown colored streaks in copper bearing clad products such as Alclad 24S resulting from diffusion of core alloying constituents to the surface of the coating during thermal treatment. (S & P)

**Drawing:** The process of pulling material through a die to reduce the size, change the cross-section shape, or to harden the material.

**Drawn-In-Scratches:** Scratches which occur during the fabricating process and are subsequently drawn over. They are characterized by a drawing over of the scratch which makes it relatively smooth to the touch.

**Drawn Product:** A product formed by pulling the material through a die.

**Drawn Shape:** Any drawn product other than Bar, Rod, or Tube. See also Solid Drawn Shape, Semi-Hollow Drawn Shape, and Hollow Drawn Shape.

**Drawn Tube:** A tube produced by drawing through a die.

**Drilled Extrusion Ingot:** A cast solid extrusion ingot which has been drilled to make it hollow.

**Earing:** The characteristic of forming ears when deep drawn or spun. (S & P)

**Ears:** Wavy symmetrical projections formed in the course of deep drawing or spinning as a result of directional properties or anisotropy of the sheet. Ears occur in groups of 4 to 8 with the peaks of the projections being located at 45° and/or 0° and 90° to the rolling direction. Degree of earing is the difference between average height of the peaks and average height of the valleys, divided by average height of the valleys, multiplied by 100 and expressed in per cent.

**Eccentricity:** Deviation from concentricity. The difference between the maximum wall thickness and minimum wall thickness at any one cross-section. The degree of eccentricity can be expressed by a plus or minus wall thickness tolerance.

**Electrical Metallic Tubing:** A tube having certain standardized lengths and combinations of outside diameter and wall thickness, thinner than those of Rigid Conduit, commonly designated by nominal electrical trade sizes, for use with compression-type fittings as a protection for electrical wiring.

**Embossed Tube:** A tube, the outside surface of which has been embossed by means of rolling with a design in relief regularly repeated in the longitudinal direction.

**Equivalent Round:** The diameter of a circle having a circumference equal to the outside perimeter of a given shape or tube.

*Turn to Page 348*

# SW-65

**Bar No. 4512-1**
**¼" electrode**
**on D.C. Reverse**
**As Welded**

Yield Point, 65,700 psi. Tensile Strength, 75,000 psi. % Elongation, 30.0 % Reduction Area, 65.6

# Outstanding physicals recommend the A. O. Smith SW-65

## low-hydrogen electrode

**Here is a picture** of an all weld metal .505 of the A. O. Smith SW-65 low-hydrogen electrode. Remarkable strength, superior ductility and exceptional elongation put this electrode in a class by itself.

**Nominally an E6016** electrode, it far exceeds A.W.S. specifications for this class. It is used in many applications as an E7016 because of its superior physicals.

**Its better manipulation,** lack of spatter, easy re-strike, quick cleaning slag and fine appearing bead make it an operator's favorite from the very first trial.

**With SW-65,** you have the exceptional electrode for welding cold-rolled steel, re-rolled rail, high carbon, sulphur, selenium bearing steels and steels of poor weldability.

**This is the electrode** to use with confidence whenever there is any doubt about weldability, and where you desire high physical and x-ray quality.

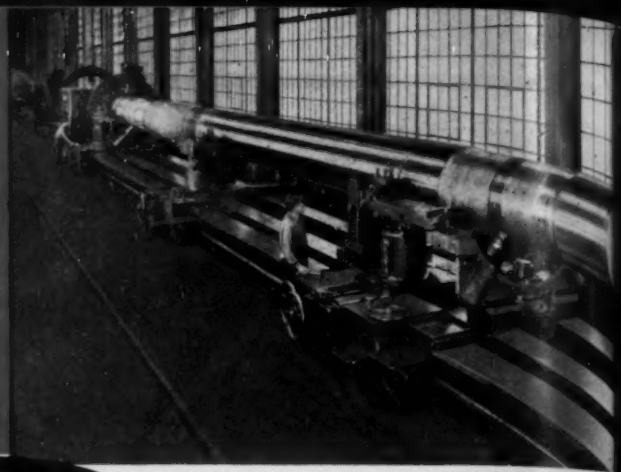
**May we suggest** that you write us or contact your local A. O. Smith distributor for full details and a chance to test this remarkable low-hydrogen electrode.

**A.O.Smith**
**CORPORATION**

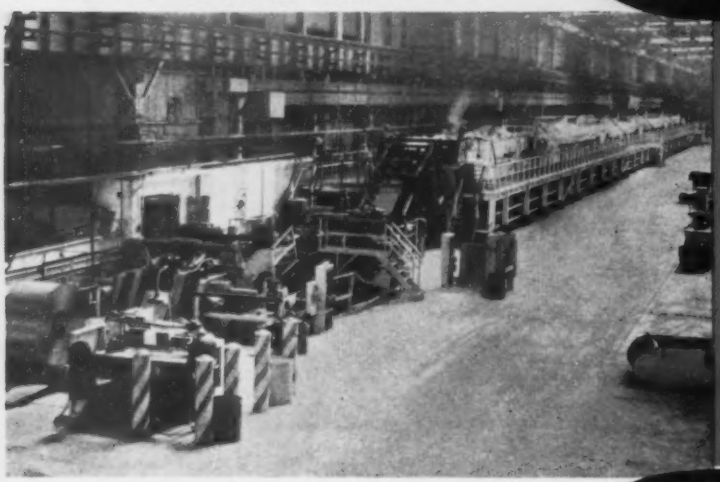
**WELDING PRODUCTS DIVISION, MILWAUKEE 1, WISCONSIN**
**INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN**

MESTA 60" SHEET SHEARING LINE WITH TRIMMER AND COMBINATION FLYING SHEAR AND LEVELLER

**MESTA**

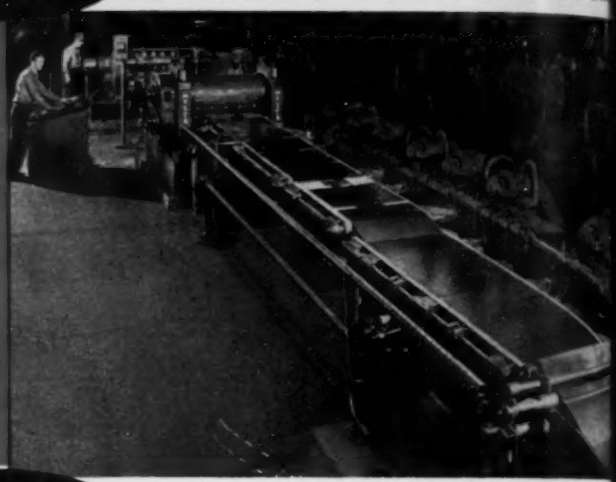


MACHINING FORGED STEEL COLUMN FOR A MESTA 50,00 HYDRAULIC PRESS ON A MESTA 96" HEAVY DUTY LA

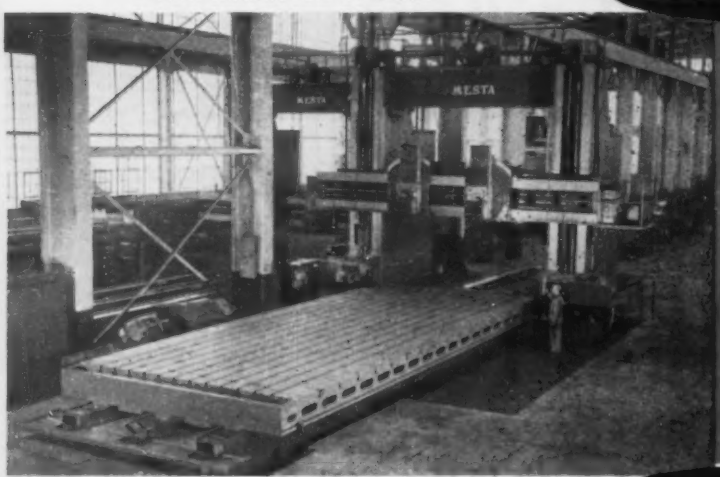


MESTA 60" CONTINUOUS PICKLING LINE WITH TRIMMER AND UP-COILER

**MESTA**

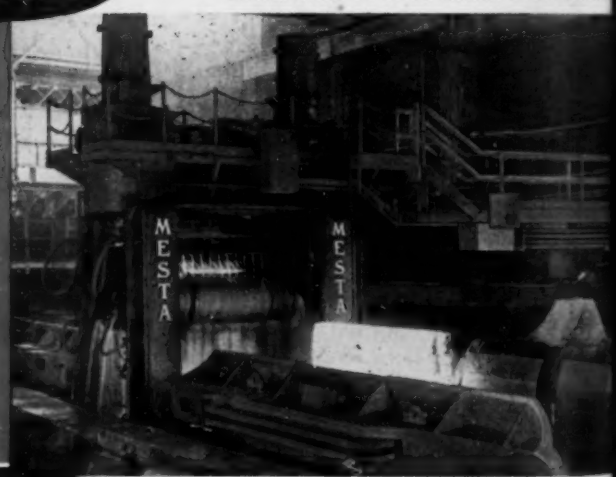


MESTA 42" TIN SHEARING LINE WITH TRIMMER COMBINATION FLYING SHEAR AND LEVELLE

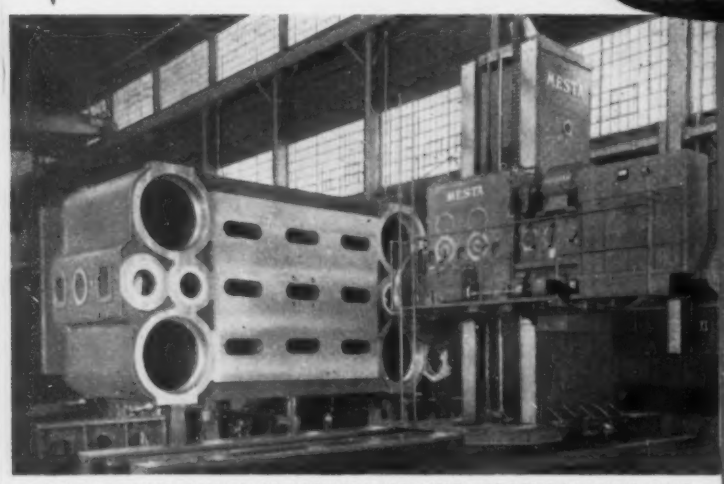



MESTA 15' HEAVY DUTY TRAVELING TABLE TYPE PLANER

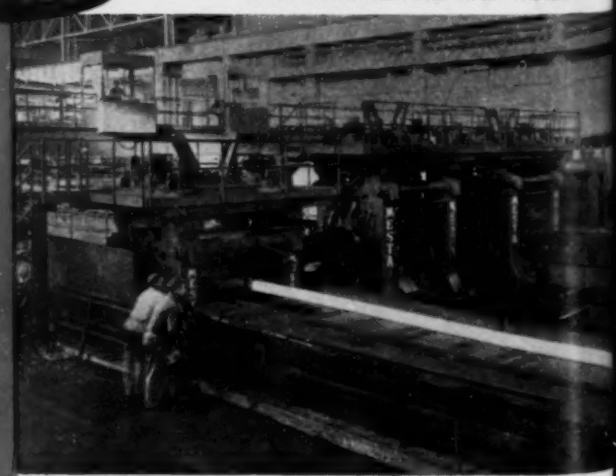
**MESTA**




MESTA 46" TWO-HIGH REVERSING SLABBING-BLOOMIN WITH MANIPULATORS AND TABLES




MACHINING CAST STEEL BASE SECTION FOR MESTA 50,000 TON HYDRAULIC PRESS ON A MESTA 18" HORIZONTAL BORING AND MILLING MACHINE



MESTA 29" STRUCTURAL MILL WITH TRAVELING TILTING T

## —Aluminum Terms—

**Extruded Bar:** A solid extrusion whose cross-section is completely symmetrical and is square or rectangular with sharp or rounded corners or edges, or is a regular hexagon, octagon, or ellipse. See also, Bus Bar.

**Extruded Product:** Same as an Extrusion.

**Extruded Rod:** A solid extrusion whose cross-section is round. See also, Welding Rod and Brazing Rod.

**Extruded Shape:** Any extrusion other than Bar, Rod, or Tube. See also, Solid Extruded Shape, Semi-Hollow Extruded Shape, Hollow Extruded Shape, Stepped Extruded Shape, Tapered Extruded Shape, Helical Extruded Shape, Spiral Extruded Shape, Structural Shape, and Standard Structural Shape.

**Extruded Tube:** A tube produced by extrusion.

**Extrusion:** A product formed by pushing the material through an orifice in a die.

**Extrusion Billet:** A solid wrought semi-finished product intended for further extrusion into Rods, Bars, or Shapes. See also Extrusion Ingot.

**Extrusion Defect:** A cone shaped cavity in an extruded shape (ring in a hollow shape or tube) formed in the extreme rear portion, if extruded too far.

**Extrusion Ingot:** A solid or hollow cylindrical casting used for extrusion into Rods, Bars, Shapes, or Tubes. See also, Drilled Extrusion Ingot, Reamed Extrusion Ingot, and Scalped Extrusion Ingot.

"Your comments on our production methods are very interesting, Forbes. I'll file them for the board to take up."

*Turn to Page 351*

## —Aluminum Terms—

**Finish:** Surface appearance of an extruded or drawn shape or tube.

**Finishes:** See Mill, one side bright, standard bright, standard one side bright.

**Flat Roofing Sheet:** Standardized sizes of flat sheet of specific temper, width, and thickness intended for the manufacture of corrugated or V-crimp roofing.

**Flat Sheet:** Flat sheet is furnished in rectangular form with sheared, slit, or sawed edges, which may be flattened by any standard method.

**Flat Sheet Circles:** Flat sheet cut into circular form.

**Fluted Hollow Shape:** A hollow shape whose cross-sectional inside periphery is plain, and whose cross-sectional outside periphery has regular, longitudinal, concave corrugations with sharp cusps between corrugations.

**Fluted Tube:** A tube of nominally uniform wall thickness, having regular, longitudinal, concave corrugations with sharp cusps between corrugations.

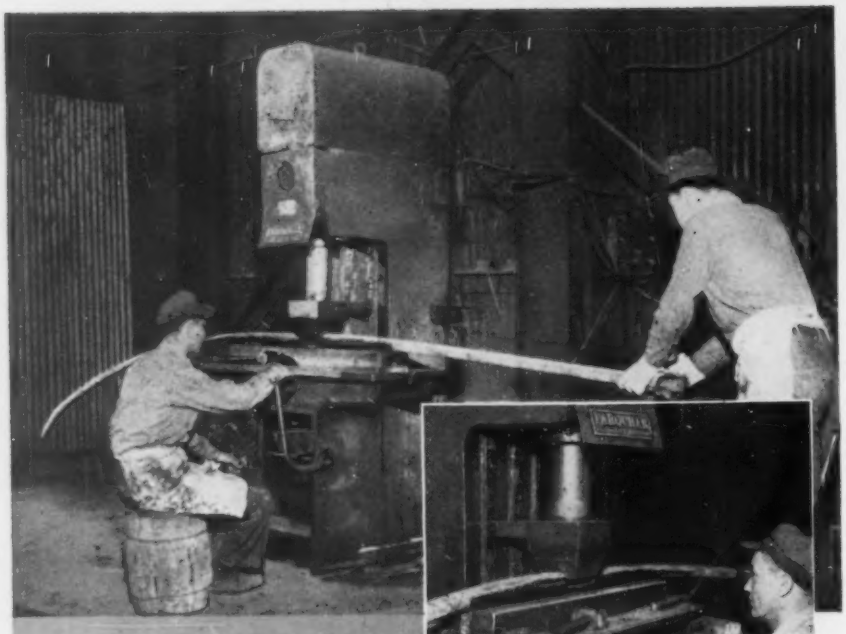
**Foil Stock:** Semi-finished coiled material for further rolling into foil (thinner than 0.006 in.).

**Forging Stock:** A wrought rod, bar or other section suitable for subsequent change in cross-section by forging.

**Gauge:** The wall thickness of a tubular product expressed in terms of a system of numbers. Not a measuring device when used in this sense. While Birmingham or Stub Gauge numbers are used for tubular products, wall thicknesses expressed in decimals are preferred.


"The heck with 'cops and robbers,' let's play 'board of directors'—that's lots noisier."

*Turn Page*



Farquhar Hydraulic Press at the Weirton Steel Company straightens stopper rods. It has doubled production, required practically no maintenance.

# Farquhar Hydraulic Press

## at the Weirton Steel Co.

### "eliminates breakage of rods...increases production 100%"

The Weirton Steel Co., Weirton, W. Va., formerly straightened stopper rods with a steam hammer. The operation was slow and resulted in a high percentage of breakage. Seeking a better method, Weirton officials bought a Farquhar Press to speed production. Not only has the press increased production 100%, but it has eliminated breakage of rods. In addition, Weirton reports that in the six years this press has been operating, "practically no maintenance has been necessary."

**Farquhar Presses Cut Your Costs**

Just one more example of cost-cutting Farquhar performance in modern production! Farquhar Presses are built for the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of the extra guides on the moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost.

Farquhar engineers are ready to help solve whatever production problem you may have. Send for free catalog showing Farquhar Built-for-the-Job Presses in all sizes and capacities. Write to THE OLIVER CORPORATION, A. B. Farquhar Division, *Hydraulic Press Dept.*, 1503 Duke St., York, Pennsylvania.

Farquhar

HYDRAULIC PRESSES

for Bending • Forming • Forcing • Straightening • Assembling • Drawing
Extruding • Joggling • Forging • and other Metalworking Operations

THE OLIVER CORPORATION, A. B. FAROUHAR Division

## —Aluminum Terms—

**Gouge.** A gross type of scratch.

**Grain Size:** All metals are crystalline in structure. The crystals are generally referred to as grains. Grain size is a measure of the individual crystal size and is usually reported in terms of grains per unit area (e.g., $mm^2$) or unit volume (e.g., $mm^3$).

**Heat Exchanger Tubes:** Tubes generally conforming to A.S.T.M. Spec. B-234 designed to be used in apparatus in which fluids inside the tubes are heated or cooled by fluids outside the tubes. The term is usually not applied to coiled tube, or to tubes used in refrigerators or radiators.

**Heat Treat Stain:** Discoloration of the metal surface caused by oxidation during thermal treatment.

**Helical Extruded Shape:** An extruded shape twisted along its length. (Sometimes erroneously called "spiral".)

**Helical Welded Tube:** A tube formed from sheet and fastened at the seam by welding, with the weld line curved around the tube like an ordinary screwthread.

**Herringbone Streaks:** Elongated, alternate bright and dull markings at an angle to the rolling direction of the sheet. Such streaks have the general appearance of a herringbone pattern.

**Hollow Drawn Shape:** A drawn shape, any part of whose cross-section completely encloses a void.

**Hollow Extruded Shape:** An extruded shape, any part of whose cross-section completely encloses a void.

". . . started on shoestring, went heavily into debt and lost even the shoestring."

## —Aluminum Terms—

Class 1. **Hollow Extruded Shape**—A hollow extruded shape whose void is round and one inch or more in diameter, and whose weight is equally distributed on opposite sides of two or more equally spaced axes.

Class 2. **Hollow Extruded Shape**—Any hollow extruded shape other than Class 1, having a single void and not exceeding a five inch circumscribing circle diameter in size.

Class 3. **Hollow Extruded Shape**—Any hollow extruded shape other than Class 1 or Class 2.

**Hollow Shape:** A shape any part of whose cross-section completely encloses a void. See also Hollow Drawn Shape and Hollow Extruded Shape. (E & T)

**Homogenizing:** This term is not recommended. The term "Preheating" is preferred.

**Ingot:** A casting, suitable for working or remelting, that has been poured from either a melting or blending furnace. (E & T)

**Kinks:** Small creases or indentations caused by localized bending during handling, etc.

**Laminations:** Internal cracks aligned parallel to the worked surface of the sheet.

**Lap Welded Tube:** A tube formed from sheet by lapping the edges and joining by welding.

**Lateral Bow or Camber:** A longitudinal bow or curvature in the plane of the sheet.

**Lip Hollow Shape:** A hollow extruded or drawn shape of generally circular cross-section with nominally uniform wall thickness with one hollow or solid protuberance or lip parallel with the longitudinal axis, used principally for heat exchange purposes. (E & T)

**Lithographic Sheet:** Sheet, having a superior surface on one side with respect to freedom from surface imperfections and supplied with a maximum degree of flatness, for use as a plate in offset printing.

**Lock Seam Tube:** A tube formed from sheet with a longitudinal, mechanically locked seam.

**Lueders Lines:** Surface markings resulting from localized flow which appears on some alloys after light forming. They lie approximately

*Turn Page*

## —Aluminum Terms—

parallel to the direction of maximum shear stress (about 45° to direction of applied stress). They appear as depressions when forming is in tension and as elevations when in compression.

**Mean Diameter:** The average of two measurements, on the diameter of a tube, taken at right angles to each other.

**Mean Wall Thickness:** The average of two measurements, on the wall thickness of a tube, taken opposite each other.

**Mill Finish:** Sheet material, having an uncontrolled finish which may vary from sheet to sheet and within a sheet, may not be entirely free from stains or oil.

**Non-Metallic Inclusion:** Non-metallic foreign material introduced into the metal during the remelting or casting operation.

**Odd-Shaped Plate Blanks:** Plate material cut into shapes other than circles or rectangles.

**Odd-Shaped Sheet Blanks:** Sheet material cut into shapes other than circles or rectangles.

**Off Gauge:** Deviation of the wall thickness of a tubular product beyond the standard or specified wall thickness tolerances. (E & T)

**Off Gauge:** Thickness outside the specified tolerance. (S & P)

**Oil Stain:** Stains produced by the incomplete burning of lubricants on the surface of a product. Drawing subsequent to staining will change color from darker browns to lighter browns down to white.

**One Side Bright Mill Finish:** Sheet material having a moderate degree of brightness on one side. The reverse side is uncontrolled and may have a dull, non-uniform appearance.

**Open Seam Tube:** A shape approaching tubular form of nominally uniform wall thickness but having a longitudinal, unjointed seam or gap of width not greater than 25 pct of the outside diameter or greatest over-all dimension, normally produced from sheet.

**Orange Peel:** A surface roughening encountered in forming products from material which has a coarse grain size.

**Ovalness:** Deviation from a truly circular periphery, usually expressed as the total difference found at any

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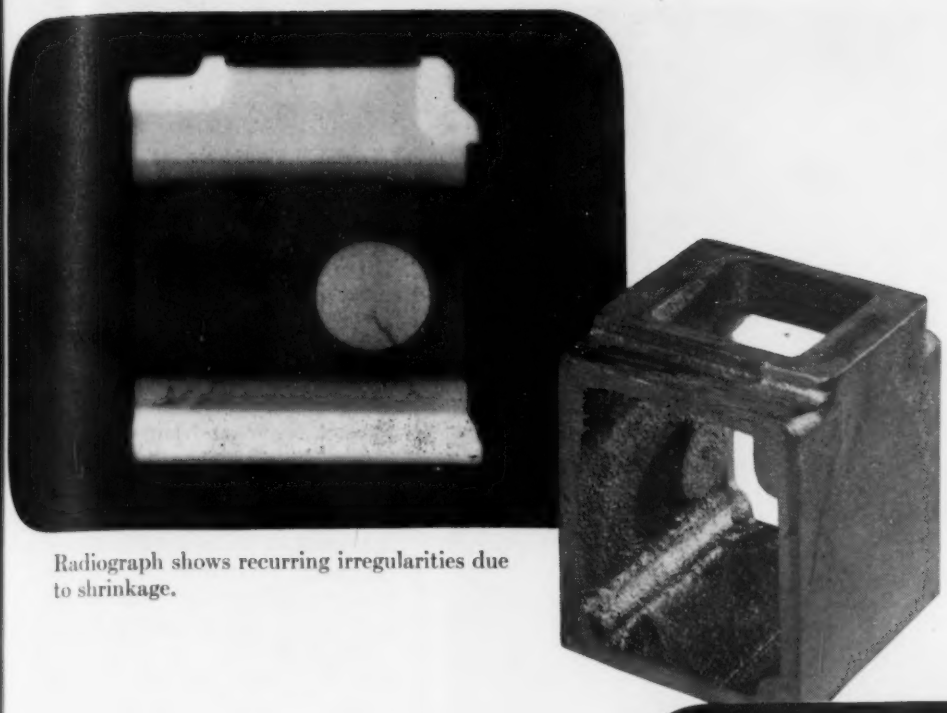
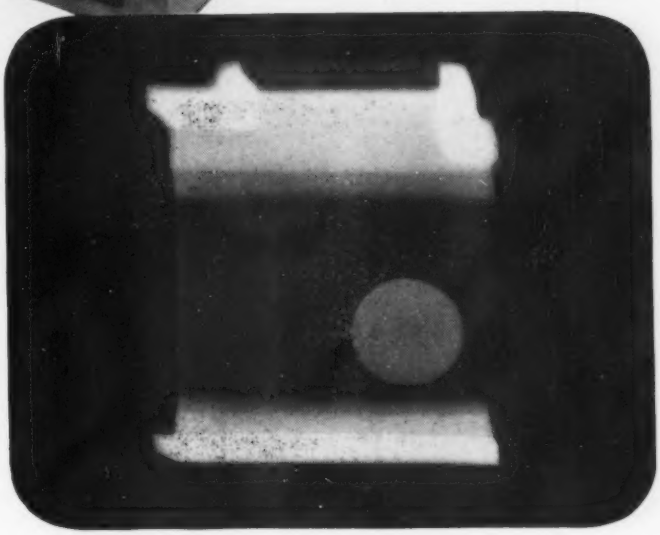


Radiograph shows recurring irregularities due to shrinkage.

# RADIOGRAPHY

## puts the finger on a profit thief



A change in gating produced sound castings.

Shrink was a problem in casting this instrument housing of 355 aluminum. It looked like the yield would run low.

But radiographs of pilot runs put the finger on the cause—revealed a pattern of recurring irregularities. This suggested a change in gating which, when adopted, quickly corrected the difficulty.

Cases like this show why more and more foundries make radiography a routine practice. It proves their work sound—helps build a reputation for consistently good castings.

Wouldn't you like to know how Radiography can work for you? Get in touch with your x-ray dealer. Or, write us for a free copy of "Radiography as a Foundry Tool."

**EASTMAN KODAK COMPANY**
**X-ray Division, Rochester 4, N. Y.**

**Radiography...**
***another important function of photography***

Kodak
TRADE-MARK

## —Aluminum Terms—

one cross-section, between the individual maximum and minimum outside diameter of a tube which usually occur at or about 90° to each other. Ovalness is not expressed as plus and minus.

**Oxide Discoloration:** Discoloration of the metal surface caused by oxidation during thermal treatment. (S & P)

**Pack Marks:** Small, densely distributed abrasions on the surface of the sheet resulting from rolling sheets in packs of two or more. The marks occur on the sheet surfaces in contact with each other.

**Patterned or Embossed Sheet:** A sheet product on which a raised or indented pattern has been impressed on either one or both surfaces by the use of rolls.

**Pick Up:** Small particles of oxidized metal adhering to the surface of an extrusion.

**Pinch Marks:** Elongated markings, generally running in a with-grain direction and resulting from a folding-over of the metal during rolling. Such folds occur at the entry side of the rolling mill and are consequently rolled over and smoothed out in the subsequent rolling. (S & P)

**Pinion Hollow Shape:** A hollow extruded or drawn shape with regular, accurately spaced, longitudinal serrations outside, and round inside, used primarily for small gears.

**Pipe:** A tube having certain standardized combinations of outside diameter and wall thickness, commonly designated by "Nominal Pipe Sizes" and "A.S.A. Schedule Numbers."

"I like to run through the plant once in a while . . . get a kick out of the rumors it starts."

## —Aluminum Terms—

**Pits:** Sharp depressions in the surface of the metal resulting in a reduction of the gauge or thickness.

**Plate:** Plate is a solid section rolled to a thickness of 0.250 in. or heavier in rectangular form and with either sheared or sawed edges.

**Plate Circles:** Plate material cut into circular form.

**Polishing:** A mechanical finishing operation for the purpose of applying a gloss or luster to the surface of a product.

**Preheating:** A high temperature soaking treatment used to change the metallurgical structure in preparation for a subsequent operation, usually applied to the ingot.

**Reamed Extrusion Ingot:** A cast hollow extrusion ingot which has been machined to remove the original inside surface.

**Recording Sheet Circles, No. 2:** Circles for professional use cut from sheet of maximum flatness, surface quality and clean and free from oil.

**Recording Sheet Circles, No. 3:** Circles for home or amateur use supplied with a good degree of flatness, clean and free from oil.

**Redraw Tube:** This term is not recommended. The term "Tube Stock" is preferred.

**Reflector Sheet, No. 1:** Non-clad sheet of controlled composition suitable for use in the manufacture of diffuse-type reflectors.

**Reflector Sheet, No. 2:** Clad sheet of controlled composition suitable for use in the manufacture of specular-type reflectors.

**Reheating:** A thermal operation designed solely to heat ingots to hot forming temperatures. In general, no structural changes are intended.

**Rigid Conduit:** A tube having a certain standardized length and combinations of outside diameter and wall thickness greater than Electrical Metallic Tubing, commonly designated by nominal sizes corresponding to those of A.S.A. Schedule 40 Pipe, for use with thread-type fittings as a protection for electrical wiring.

**Ring Condition:** A groove, revealed by caustic etching the cross-section, generally following the outline of the extruded shape and formed from the liquated surface of an extrusion ingot. This condition, depending upon severity, may or may not be considered defective.

*Turn Page*

## —Aluminum Terms—

**Rolled-In Metal:** An extraneous chip or sliver of metal rolled into the surface of the sheet.

**Rolled-In Scratches:** Scratches which occur during the fabricating process and are subsequently rolled over. They are characterized by a rolling-over of the scratch which makes it relatively smooth to the touch. (S & P)

**Roll Marks:** A raised area on the sheet caused by the imprint of a pit or depression in the rolls during the rolling operation.

**Roundness:** This term is not recommended. The term "Ovalness" is preferred.

**Rubmark:** A minor form of scratching consisting of areas made up of a large number of very fine scratches or abrasions. See Torn Surface.

**Scalped Extrusion Ingot:** A cast solid or hollow extrusion ingot which has been machined on the outside surface.

**Scratch:** A mark on the surface of the product produced by scratching. Such marks are generally rough to the touch. See also, Gouge and Rubmark.

**Seamless Tube:** A tube having an initial continuous periphery as when produced by extrusion or by drawing through a die.

**Section Number:** The number assigned to an extruded or drawn shape for identification and cataloging purposes, usually the same number that is assigned for the same purpose to the die from which the shape is made.

**Semi-Hollow Drawn Shape:** A drawn

"Hot as hell today."

## Aluminum Terms

shape, any part of whose cross-section partially encloses a void, and in which the area of the void is substantially greater than the square of the width of the gap. (E & T)

**Semi-Hollow Extruded Shape:** An extruded shape, any part of whose cross-section partially encloses a void, and in which the area of the void is substantially greater than the square of the width of the gap. (E & T)

**Semi-Hollow Shape:** A shape, any part of whose cross-section partially encloses a void and in which the area of the void is substantially greater than the square of the width of the gap. (E & T)

**Shape:** A product, other than Rod, Bar, or Tube, whose longitudinal dimension is substantially greater than its cross-sectional dimensions, produced by extrusion, rolling, or by drawing through a die. See also, Solid Shape, Semi-Hollow Shape, Hollow Shape, and Stepped Shape. (E & T)

**Sheet:** Sheet is a solid section rolled to a thickness range of 0.006 in. to 0.249 in. inclusive, supplied with sheared, slit, or sawed edges. (See also: Coiled, flat, coil, odd-shaped.)

**Sheet Stock — Coiled:** Semi-finished rough rolled material, in coiled form, for further rolling into sheet.

**Side Set:** A difference in gauge between the two edges of a sheet.

**Slivers:** Slender fragments or splinters which are an integral part of the material but which are incompletely attached to the metal.

**Solid Drawn Shape:** Any drawn shape other than a hollow or a semi-hollow drawn shape. (E & T)

**Solid Extruded Shape:** Any extruded shape other than a hollow or a semi-hollow extruded shape. (E & T)

**Solid Shape:** Any shape other than hollow or semi-hollow. (E & T)

**Special Tolerance Sheet:** Sheet produced to closer-than-standard tolerances for thickness, width, and/or length.

**Specialty Sheet:** See Anodizing, brazing, coiled roofing, flat roofing, lithographic, patterned or embossed, recording, reflector, utility.

**Spiral Shape:** Erroneously used sometimes where the term "Helical Extruded Shape" is intended. (E & T)

*Turn Page*

**Spiral Welded Tube:** A tube formed from sheet which has been spiral wrapped prior to joining by welding.

**Squareness:** Characteristic of having sides straight and parallel with 90° corners. Out-of-squareness is measured as the deviation of an end edge of the sheet from a straight line at right angles to a side and touching one corner.

**Standard Bright Finish:** Sheet material having a relatively bright, uniform appearance on both sides but somewhat less lustrous than the standard one side bright material.

**Standard One Side Bright Finish:** Sheet material having a uniformly bright and lustrous surface on one side. The reverse side is uncontrolled and may have a dull non-uniform appearance.

**Standard Structural Shape:** Any shape, rolled or extruded, commonly used for structural purposes but limited to shapes commonly produced by rolling, such as angles, channels or zees.

**Stepped Drawn Tube:** A drawn tube whose cross-section changes in area at intervals along its length.

**Stepped Extruded Shape:** An extruded shape whose cross-section changes in area at intervals in its length.

**Stepped Shape:** A shape usually produced by extrusion, whose cross-section changes in area at intervals in its length.

**Stock:** See Forging Stock and Tube Stock.

**Streamline Hollow Shape:** A hollow extruded or drawn shape with a cross-section of tear drop shape.

**Structural Shape:** Any shape used for structural purposes. See also Standard Structural Shape.

**Structural Streaks:** Streaks revealed by etching or anodizing and resulting from structural heterogeneities within the product.

**Tapered Extruded Shape:** An extruded shape whose cross-section changes in area continuously in its length or a specified portion thereof.

**Tolerance:** Allowable deviation from a nominal or specified dimension.

**Close Tolerance:** Any Special Tolerance that is closer than Standard.

**Commercial Tolerance:** This term is sometimes used synonymously with "Standard Tolerance." In such cases the term "Standard Tolerance" is preferred.

**Published Tolerance:** This term is sometimes used synonymously with "Standard Tolerance." In such cases the term "Standard Tolerance" is preferred.

**Special Tolerance:** Any tolerance that is closer or wider than Standard.

**Standard Tolerance:** An established tolerance for a certain class of product. This term is preferred to "Commercial" or "Published tolerance.

**Wide Tolerance:** Any Special Tolerance that is wider than Standard.

**Tools:** The term usually used to describe dies, mandrels, etc., necessary to produce extruded or drawn shapes or tube.

**Torn Surface:** A deep longitudinal rubmark resulting from abrasion by extrusion or drawing tools.

**Traffic Marks:** Abrasions which result from metal to metal contact and vibration during transit. These abrasions are usually dark in appearance because of the presence of

a dark powder consisting of aluminum and aluminum oxide fines produced by the abrasive action of the sheets, extruded or drawn shapes or tubes rubbing together.

**Transverse Bow:** Convexity of the sheet across the width.

**Tube:** A hollow product, whose cross-section is completely symmetrical and is round, square, rectangular, octagonal, or elliptical, with sharp or rounded corners, and whose wall is of uniform thickness except as affected by corner radii. See also Extruded Tube and Drawn Tube.

**Tube Bloom:** This term is not recommended. The term "Tube Stock" is preferred.

**Tube Stock:** A semi-finished tube intended for subsequent reduction in cross-section.

**Tubing:** This term is not recommended. The term "Tube" is preferred. Tube makes tubing when two or more lengths are joined.

**Tubular Conductor:** A bus conductor of any tube section.

**Tubular Product:** A general term, comprising Tube, Hollow Shape, and Semi-Hollow Shape.

**Twist:** A winding departure from flatness.

**Utility Sheet:** Mill finish coiled or flat sheet of unspecified composition and properties produced in specific standard sizes and suitable for general building trade usage.

**Water Stains:** A superficial etching of the surface from prolonged contact with moisture in a restricted air space such as between wraps of a coil or other layers of a product. Such stains are generally white in appearance.

**Welded Tube:** A tube formed from sheet and fastened at the seam by welding. See also Butt Welded Tube, Lap Welded Tube, Helical Welded Tube, and Spiral Welded Tube.

**Welding Rod:** Rod (rolled, extruded, or cast) produced for use in joining metals by welding.

**Whip Marks:** Elongated markings, generally running in a cross-grain direction and resulting from a whipping of the sheet as it enters the rolling mill.

# Copper and Brass Terms

**Acid Dipped—Dry Rolled Finish:** The finish obtained by cold dry rolling on polished rolls of material previously bichromate dipped or bright dipped, giving a burnished appearance and retaining the color obtained by dipping.

**Angle:** A shape consisting of two straight legs of equal and uniform thickness, meeting in a right angle, usually but not necessarily of equal length, and with a sharp or slightly rounded corner and with or without fillets.

**Annular Ring:** See Circular Ring.

*Turn Page*

## —Copper Terms—

**Anode:** A cast, electro-deposited, rolled, extruded or drawn positive electrode for use in a plating bath.

**Bar:** (See also bus bar.) A rectangular or square solid section up to and including 12 in. in width and over 0.188 in. in thickness. Edges of drawn or rolled edge Bar may be square or of other contours. Drawn or rolled edge Bar may have previously been slit, sheared or sawed. The dimensional limits shown above for Bar do not apply to Copper Bus Bar which is a special product used for electrical purposes and is available in a greater range of thicknesses. Types: Cold rolled, drawn, extruded (as extruded), hot rolled, rolled (edges sheared, sawed or machined), rolled edge.

**Belly:** This term is not recommended. Use instead the term "Crown," "Buckle" or "Dish."

**Bichromate (Dichromate) Dipped Finish:** The finish obtained by immersion in a solution of a bichromate and sulphuric acid, resulting in substantially complete removal of scale and oxide and giving a color approaching the true color of the metal.

**Blank:** A piece from any product intended for subsequent fabrication.

**Bow:** This term is not recommended. Use instead the term "Edgewise Curvature."

**Brazed Tube:** Tube made from sheet or strip, with a longitudinal brazed joint.

**Brazing Rod:** Rod which is manufactured to specially controlled chemical composition for use in joining metals by brazing.

**Brazing Solder:** Granulated copper-zinc alloy which is manufactured to specially controlled chemical composition for use in joining metals by brazing.

"Keltmeier!! Is that my crescent wrench you're using?"

## —Copper Terms—

**Brazing Wire:** Wire which is manufactured to specially controlled chemical composition for use in joining metals by brazing. See also Brazing Rod.

**Bright Dipped Finish:** The finish obtained by final immersion in suitable oxidizing acid solution resulting in a complete removal of scale and oxide and giving the true color or approximately the true color of the metal.

**Buckle:** Alternate bulges and hollows recurring along the length of the product with the edges remaining relatively flat.

**Buffed Surface:** See Polished Surface.

**Bull Ring Rod:** Specially surfaced rod for manufacture of bull rings and other items requiring such surface.

**Bull Rod:** This term is not recommended. Use instead the term "Redraw Wire."

**Bunch Coil:** A coil helically wound and subsequently bunched. (The unqualified term "Coil" applied to either tube or wire would normally indicate a bunch coil.)

**Burr:** The thin ridge or roughness left by a cutting operation such as slitting, shearing, blanking or sawing.

**Bus Bar:** A bus conductor of rectangular or square cross-section of any dimension.

**Bus Conductor:** A rigid, high conductivity copper electrical conductor of any section, used to consolidate electrical energy received from, or to distribute it to, a plurality of locations.

**Butt Seam Tube:** See Open Seam Tube.

**Camber:** This term is not recommended. Use instead the term "Edgewise Curvature," "Crown" or "Dish."

**Capacitor Plate Stock:** Strip manufactured to special flatness and thickness tolerances, for use in electrical variable condensers.

**Center:** This term is not recommended. Use instead the term "Crown."

**Channel:** A shape having two straight flanges or legs of equal length, extended at right angles from the same side of the edges of a web or base, the legs and base being of equal and uniform thickness, and with sharp or slightly rounded corners and with or without fillets.

*Turn Page*

## —Copper Terms—

**Circle:** A completely round, commercially flat, solid blank made from a flat rolled product.

**Circular Ring:** A completely round, commercially flat blank lacking the central concentric area (sometimes called an Annular Ring).

**Coil:** (See also Roll.) A length of a product other than flat rolled or flat drawn, wound into a merchantable hoop-like bundle (does not apply to coils fabricated to specifications).

**Cold Rolled Finish:** The finish obtained by cold rolling plain pickled strip with a lubricant, resulting in a relatively smooth appearance. In the case of sheet, cold rolling may be done without any lubricant, the finish then being similar to that described under Dry Rolled Finish.

**Commutator Segment Bar:** A shape of trapezoidal cross section for manufacturing into commutator segments.

**Commutator Segments:** Elements usually cut from commutator segment bar.

**Condenser or Heat Exchanger Tube:** Tube manufactured to special requirements as to tolerances, finish and temper.

**Condenser Tube Plate:** Plate manufactured to special thickness tolerances and furnished in various contours as tube sheets or head plates in condensers and heat exchangers.

**Copper Water Tube:** Seamless copper tube of certain standardized sizes, in straight lengths and coils, used with flared or soldered joints for the conveyance of gases and liquids.

**Crimped Copper:** Copper in sheets or strips having relatively small transverse corrugations applied subse-

"He's made a name for himself, but I'd rather not say what it is."

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## —Copper Terms—

quent to normal finishing operations to provide for expansion, to increase rigidity or for ornamental purposes.

**Crown:** The variation in thickness across the product from edge to center or edge to edge.

**Disc:** See Circle.

**Dichromate Dipped Finish:** See Bichromate Dipped Finish.

**Dish:** The transverse departure of the concave surface from a straight line from edge to edge.

**Double Layer Flat Coil:** (Also called Double Layer Pancake Coil or Double Layer Spirally Wound Coil). A coil in the form of two flat, spirally wound layers (applied particularly to copper water tube or refrigerator tube).

**Drawn Edges:** Finished edges, the final contours of which are produced by drawing through a die. The edge contours most commonly used are square corners, rounded corners, rounded edge and full rounded edge.

**Drawn Finish:** The finish obtained on tube, wire, and drawn rod, bar and strip by drawing through a die, resulting in a relatively smooth and bright appearance.

**Drawn Flat Product:** Flat product brought to final dimensions by drawing through a die, and furnished in flat straight lengths, on spools, or in rolls. The edges may be square or of other contours. Types: Drawn bar, drawn flat wire, drawn strip.

**Driving Band Blank:** See Rotating Band Blank.

**Dry Rolled Finish:** (Bright Rolled Finish). The finish obtained by cold rolling on polished rolls without the


"Some order, eh Maxwell?"

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## —Copper Terms—

use of any coolant or metal lubricant, of material previously plain pickled, giving a burnished appearance.

**Edgewise Curvature:** The lateral departure of the edge from a straight line, which may be unidirectional or reversing; in the latter case sometimes called "Snaky".

**Embossed Strip:** A rolled flat product, one or both surfaces of which have been embossed by means of rolling with a design in relief regularly repeated in a longitudinal direction.

**Embossed Tube:** Tube, the outside surface of which has been embossed by means of rolling with a design in relief regularly repeated in a longitudinal direction.

**Equivalent Round Tube:** The equivalent round of a tube other than round, is the circular tube which has the same wall thickness as the average wall thickness of the tube under consideration and the same weight per linear foot.

**Extruded Finish:** The finish obtained on tube, wire, rod and bar by hot extrusion through a die, resulting in a slightly oxidized and dull appearance.

**Finished Edges:** Smooth edges produced by drawing or rolling (with or without previous slitting).

**Flat Wire:** Flat product up to and including 0.188 in. in thickness, and up to and including 1¼ in. in width, with all surfaces rolled or drawn, without previously having been slit, sheared or sawed. Flat wire may be furnished either in straight lengths or in coils or on spools, reels or bucks. Types: Drawn flat, rolled flat, square.

**Flat Product:** A rectangular or square solid section of relatively great length in proportion to thickness.


"I guess I drink a lot because it's the only thing I can do really well."

*Turn Page*

## —Copper Terms—

**Fluted Outside, Plain Inside Tube:** Tube having fluted outside periphery and plain inside periphery.

**Fluted Tube:** Tube of nominally uniform wall thickness, having regular longitudinal, concave corrugations with sharp cusps between corrugations.

**Formed Shape:** Shape made from a flat product and brought to final dimensions by bending laterally by means of rolls or brakes. If the longitudinal gap is less than 25% of the outside diameter or greatest overall dimension, the product is classified as an Open Seam Tube.

**Hand Straightening:** The process of straightening by bending or twisting by hand with the aid of adjustable supports and suitable hand tools and usually applied to shapes and to large diameter tubes.

**Heat Exchange Plate:** See Condenser Tube Plate.

**Heat Exchanger Tube:** See Condenser or Heat Exchanger Tube.

**Helical Coil:** Coil in the form of a regular cylindrical helix.

**Hexagon Tube:** Tube of regular hexagonal cross-section with uniform wall thickness.

**Hinge Strip:** Rolled strip specially straightened, primarily intended for the manufacture of long or continuous hinges.

**Hot Rolled Finish:** (Left Black). The finish obtained by rolling metal while hot, resulting in a dark oxidized and relatively rough surface.

**Note: This material may subsequently be pickled, bichromate dipped, or bright dipped, but the relatively rough surface remains.**

**Humpy:** This term is not recommended. Use instead the term "Buckle".

**Inclined Roll Straightening:** The process of straightening round rod or tube by passing the product through a machine with rolls having special contours and whose axes are at a slight angle so as to give the product a helical forward motion with repeated flexing in all planes through the axis.

**Ingot:** A casting used for remelting, usually made in an open mold.

**Kerosene Rolled Finish:** (Also Soap Rolled and Soluble-oil Rolled). The finish obtained by cold rolling with

## —Copper Terms—

kerosene, soap or soluble-oil as a lubricant, giving a semi-burnished appearance.

**Lip Tube:** Tube of generally circular cross-section with nominally uniform wall thickness with one hollow or solid protuberance or lip parallel with the longitudinal axis, used principally for heat exchange purposes, particularly in the dairy industry.

**Lock Seam Tube:** Tube formed from sheet or strip, with a longitudinal, mechanically locked seam.

**Longitudinal Curl:** A unidirectional departure from longitudinal flatness.

**Machined Edges:** The edges produced by planing, milling or shaping.

**Multiple Lengths:** Lengths of integral multiples of a base length, with suitable allowance for cutting if and as specified. Several different multiples of the base length may be included in any lot, at the mills' discretion.

**Octagon Tube:** Tube with regular octagonal cross-section with uniform wall thickness.

**Open Seam Tube:** A shape approaching tubular form of nominally uniform wall thickness but having a longitudinal, unjoined seam or gap of width not greater than 25% of the outside diameter or greatest over-all dimension.

**Patent Leveling:** See Stretcher Straightening.

**Pinion Rod:** A shape with regular, accurately spaced, longitudinal serrations, used primarily for small gears.

**Pinion Tube:** A tube with regular, accurately spaced, longitudinal serrations outside and round inside, used primarily for small gears.

*Turn Page*

## —Copper Terms—

**Pipe:** Seamless tube conforming to the particular dimensions commercially known as "Standard Pipe Sizes."

**Piston Finish Rod:** Round rod having a special surface produced by turning or grinding with close tolerances for diameter and straightness.

**Plain Tube Other Than Round, Hexagonal or Octagonal:** Tube of nominally uniform wall thickness and of simple, symmetrical cross-section, such as rectangles, squares, triangles, halfrounds, ovals and ellipses.

**Plate:** A flat rolled product over 0.188" in thickness and over 12" in width.

**Platers Bar:** A rectangular section, specially surfaced, for use as a base to which precious metal is to be applied before rerolling, for the jewelry and similar trades.

**Platers Core:** A round section, specially surfaced, for use as a base to which precious metal is to be applied before rerolling, for the jewelry and similar trades.

**Polished Surface (Buffed Surface):** The finish obtained by buffing with rouge or similar fine abrasive, resulting in a high gloss or polish. This may be applied in one operation or two, commonly known as cutting and coloring operations.

**Polygonal Outside, Round Inside Tube:** Tube with regular, polygonal, outside periphery and nominally concentric circular inside periphery.

**Press Straightening:** The process of straightening bar and large size rod and tube by means of mechanically or hydraulically actuated presses.

**Printers Rule:** Strip manufactured to special straightness requirements, for use in typography.

**Product:** Plate, sheet, strip, rod, bar, wire, pipe, tube or shape rolled, drawn or formed of copper, brass, bronze or related alloy (but not including wire and cable of copper and copper alloy for electrical transmission).

**Projectile Bank Blank:** See Rotating Band Blank.

**Random Lengths:** Run-of-mill lengths without any indicated preferred length.

**Red Dip Finish:** This term is not recommended. Use instead the term "Bichromate Dipped Finish."

**Redraw Tube.** Tube within a limited range of sizes, for further drawing.

**Redraw Wire:** Wire within a limited

## Copper Terms

range of sizes, for further drawing or rolling.

**Reeded Outside, Plain Inside Tube:** Tube having reeded outside periphery and plain inside periphery.

**Reeded Tube:** Tube of nominally uniform wall thickness, having longitudinal convex corrugations either with rounded or sharp cusps between corrugations.

**Resquared Metal (Square Sheared Metal):** A product furnished in a flat straight length, brought to final width and length by press shearing of both edges and ends. The edges are straighter than those of slit metal, with the ends at right angles to the edges.

**Ring or Disc Type Straightening:** The process of straightening rod by rotating while feeding lengthwise through a series of rotating rings or discs which flex the rod in all planes through the axis. The equipment includes a cut-to-length device for use on rod which is straightened from coils.

**Ripple:** A slight transverse wave or shadow mark repeated at intervals along the piece.

**Rod:** A round, hexagonal or octagonal solid section furnished in straight lengths. Types: Brazing, cold rolled, drawn, extruded (as extruded), hot rolled, piston finish, shafting, turned, welding.

**Rope-Fluted Tube:** Tube of nominally uniform wall thickness, both fluted and roped.

**Rope-Reeded Tube:** Tube of nominally uniform wall thickness, both reeded and roped.

**Roll:** A length of a flat rolled product wound into a cylindrical spiral except Stagger Wound Roll.

**Rolled Flat Product:** Flat product brought to final thickness by rolling,


"You might call me a sort of journeyman unskilled laborer."

*Turn Page*

## —Copper Terms—

and furnished in flat straight lengths, on spools, or in rolls. The longitudinal edges may be unfinished, or brought to final width by shearing, slitting, sawing, machining, or rolling. If rolled, the corners or edges may be square or of other contours. Types: Plate, rolled bar (edges sheared, sawed or machined), rolled edge bar, rolled flat wire, rolled strip, sheet.

**Roll Flattening:** The condition resulting from flattening by running the product through a machine with a number of small diameter cylindrical rolls so positioned as to repeatedly flex the product and thus remove certain irregularities in shape. Roll flattening will practically eliminate longitudinal curl. On annealed metal, it will largely eliminate burr and dish due to the effects of slitting. It will do this to a lesser degree on rolled tempers. It will also reduce that portion of the edgewise curvature of narrow slit strip due to slitting. This operation is less effective in eliminating buckles, and relatively ineffective in eliminating wavy edges, ripples and twist. Roll flattening is ordinarily applied to a Flat Rolled Product within the approximate size range .010" to ¼" thick and in widths up to about 48", and is particularly effective on annealed tempers, but is progressively less effective with increase in degree of rolled temper.

**Roll Straightening:** The process of straightening tube, rod and bar by passing lengthwise through a machine with suitable rolls so as to repeatedly flex the product in two planes at right angles.

**Rotating Band Blank:** A tubular blank manufactured to special tolerances, for use on artillery propectiles. Sometimes termed Driving Band Blank or Projectile Band Blank.

**Rolled Edges:** Finished edges, the final contours of which are produced by side or edging rolls. The edge contours most commonly used are square corners, rounded corners and rounded edge.

**Rotating Head Straightening:** The process of straightening rod initially produced in a coil, which comprises the rotation of a series of shaped dies pressed against the rod so as to

## —Copper Terms—

repeatedly flex the rod in all planes through the axis as it is moved forward through the machine by means of feed rolls. This type of straightening machine usually has an automatic cutting-to-length device.

**Round Outside, Polygonal Inside Tube:** Tube with outside periphery of circular section and nominally concentric, regular polygonal inside periphery.

**Satin Finish:** See Scratch Brushed Finish.

**Sawed Edges:** The edges resulting when a product is brought to final width by sawing. The edges are parallel and at right angles to the rolled surface.

**Scratch Brushed Finish (Satin Finish):** The finish obtained by mechanically brushing the surface with wire bristle brushes or by buffing with greaseless compound.

**Seamless Tube:** Tube produced with an initially continuous periphery.

**Shafting:** Round rod specially manufactured to the close straightness tolerances required for use in shafting.

**Shape:** A solid section other than rectangular, square or standard rod and wire sections, furnished in straight lengths. Types: Angle, channel, cold rolled shape, commutator segment bar, drawn shape, extruded shape, formed shape, hot rolled shape, open seam tube, tubular shape, Z bar.

**Sheared Edges:** The edges resulting from press shearing to final width. These edges are straighter than slit edges.


"What does that screwball want?"

*Turn Page*

## —Copper Terms—

**Sheet:** A flat rolled product up to and including 0.188" in thickness and over 20" in width.

**Single Layer Flat Coil:** (Also known as Pancake Coil or Single Layer Spirally Wound Coil). A coil in the form of a single flat spirally wound layer (applied particularly to copper water tube or refrigerator tube).

**Slack Center:** This term is not recommended. Use instead the term "Crown".

**Slit Edges:** The edges resulting from cutting to width by rotary slitters.

**Slug:** Term commonly applied to forging blanks. See Blank.

**Snaky:** This term is not recommended. Use instead the term "Edgewise Curvature" (Reversing).

**Soap Rolled Finish:** See Kerosene Rolled Finish.

**Soda Dip Finish:** This term is not recommended. Use instead the term "Bichromate Dipped Finish."

**Soluble-Oil Rolled Finish:** See Kerosene Rolled Finish.

**Specific Lengths:** Indicated uniform lengths, subject to established length tolerances; for example: 12'-0", 9'-7" or 0'-4½" is a specific length.

**Specific Lengths With Ends:** Indicated uniform lengths of 6 feet or over subject to established length tolerances and with ends included according to established length tolerances and with ends included according to established short length schedules; for example: 10'-0" with ends or 6'-5" with ends.

**Square Wire:** See Flat Wire.

**Stagger Wound Roll:** A multiple layer roll wound as in spooling, but with strands not necessarily of fixed regularity.

**Standard Lengths:** Standard lengths are lengths which have been recommended in a Simplified Practice Recommendation or established as a Commercial Standard by the National Bureau of Standards, United States Department of Commerce as standard lengths for certain products. Such products are Copper Water Tube and copper and brass pipe (Simplified Practice Recommendation R 217-46). Recommendations have been proposed for Automotive Service Tube and Refrigeration Service Tube.

## —Copper Terms

**Stock Lengths:** Normally certain uniform lengths subject to established tolerances (including Standard Lengths) actually carried in mill and warehouse stocks. The nominal lengths actually carried will vary considerably with the product, alloy, size, mill source and warehouse location.

**Stock Lengths With Ends:** In some products and sizes it is customary to include with stock lengths the end pieces resulting from cutting, according to established short length schedules.

**Stretcher Straightening:** (Patent Leveling.) The condition resulting from stretching to produce a flat and straight product. This process practically removes buckles, ripples, wavy edges, twist and edgewise curvature. It is partially effective in removing longitudinal curl, but is ineffective in removal of crown, dish and burr. It can be applied to a Flat Rolled Product within approximately the following size range: 3" to 48" wide and .012" to .050" thick.

**Strip:** A flat product, other than Flat Wire, up to and including 0.188" in thickness, and up to and including 20" in width, originally produced with slit, sheared or sawed edges, whether or not such edges are subsequently rolled or drawn. Types: Drawn, rolled.

**Terrazzo Strip:** A formed product with special flatness and straightness requirements made from strip or extruded sections for use as dividing strip in terrazzo floors.

**Tube:** A hollow product of round or any other cross-section, having a


"Not that we take this flying saucer business seriously, of course . . ."

*Turn Page*

## —Copper Terms—

continuous periphery. Types: Brazed, butt seam, condenser, copper water, embossed, equivalent round, extruded, fluted outside—plain inside, fluted, heat exchanger, hexagon, lip, lock seam, octagon, open seam, pinion, plain tube other than round, hexagonal, or octagonal, polygonal outside—round inside, redraw, reeded outside—plain inside, reeded, roped, rope-fluted, rope-reeded, round outside—polygonal inside, seamless, tubular shape, twisted, welded, also pipe.

**Tube Sheet:** See Condenser Tube Plate.

**Tubing:** This term is not recommended. Use instead the term "Tube."

**Tubular Shape:** Tube of non-uniform wall thickness or of irregular periphery or both.

**Twisted Tube:** Tube of symmetrical cross-section having nominally uniform wall thickness and which has been twisted.

**Wavy:** This term is not recommended. Use instead the terms "Wavy Edges" and "Ripple."

**Wavy Edges:** A wrinkled condition along the edges of the product, with a relatively flat center portion.

**Welding Rod:** Rod which is manufactured to special requirements as to chemical composition and surface cleanliness for use in joining metals by welding.

**Welded Tube:** Tube made from plate, sheet or strip, with a welded longitudinal or helical joint.

**Welding Wire:** Wire which is manufactured to special requirements as to chemical composition and surface cleanliness for use in joining metals by welding. See also Welding Rod.

**Wind:** This term is not recommended. Use instead the term "Twist."

**Wire:** A solid section, other than strip, furnished in coils or on spools, reels or bucks. Flat wire, including square, however, may also be furnished in straight lengths. Types: Brazing, cold rolled, drawn flat, extruded (as extruded), hot rolled, metallic coated, rolled flat, square, welding.

**Wrinkle:** This term is not recommended. Use instead the term "Wavy Edges."

**Z Bar:** A shape having two straight flanges or legs of equal length extending at right angles from oppo-

site sides of the edges of a web or base, the legs and base being of equal and uniform thickness and with sharp or slightly rounded corners and with or without fillets.

# Magnesium Industry Terms

**Anodic Metal:** Any metal which tends to dissolve, corrode, or oxidize in preference to another metal when the metals are connected electrically in the presence of an electrolyte.

**Bar:** A solid section whose cross section has a symmetrical shape other than round such as square, rectangular, hexagonal or octagonal and has a minimum cross sectional dimension of 0.250 in.

**Briquette:** Pellets or bricks produced by compression of metal powders with or without the inclusion of nonmetallic constituents.

**Brucite:** A naturally occurring form of magnesium hydroxide ($MgO.H_2O$).

**Carbothermic Process (Hansgirg Process):** In magnesium metallurgy, the process of reducing magnesium oxide with carbon.

**Carnallite:** A mineral ($KCL.MgCl_2.6H_2O$) made up of potassium and magnesium chlorides.

**Cathodic Metal:** Any metal which does not tend to dissolve, corrode, or oxidize in preference to another metal when the metals are connected electrically in the presence of an electrolyte.

**Cathodic Protection:** The use of an impressed current to prevent or to reduce the rate of corrosion of a metal in an electrolyte by making the metal the cathode for the impressed current.

**Chrome Pickle:** A chemical treatment for magnesium in nitric acid, so-

*Turn Page*

## —Magnesium Terms—

dium dichromate solution. The treatment gives some protection against corrosion by producing a film that is also a base for paint.

**Dichromate Process:** A chemical treatment for magnesium alloys in a boiling sodium dichromate solution, resulting in a surface film that resists corrosion.

**Dolomite:** A mineral ($CaCO_3.MgCO_3$) made up of calcium and magnesium carbonates.

**Dow Process:** A process for the production of magnesium by electrolysis of molten magnesium chloride.

**Dusting:** Applying an agent such as powdered sulfur to prevent the burning of molten magnesium alloys during pouring.

**Electrolytic Cell:** A vessel equipped with electrodes and used for the reduction of chemicals by electricity.

**Electrolytic Process:** In magnesium metallurgy, the process of electrolyzing molten magnesium chloride to form chlorine gas and molten magnesium metal.

**Electromotive:** A list of elements arranged according to their standard electrode potential.

**Epsomite:** A naturally occurring form of magnesium sulphate ($MgSO_4.7H_2O$).

**Extrude:** To shape by forcing metal, usually preheated to soften it, through dies by pressure.

**Ferrosilicon Process:** In magnesium metallurgy, the process of reduc-


"I warned you that you'd lose it."

## Magnesium Terms

ing magnesium oxide with the silicon contained in ferrosilicon.

**Hollow Shape:** An extruded shape, any part of whose cross section completely encloses a void.

**Ingot:** In magnesium metallurgy, a cast slab of solid magnesium for remelting and casting into shapes or for rolling, extrusion or forging.

**Kierserite:** A naturally occurring form of magnesium sulphate ($MgSO_4.H_2O$).

**Magclad:** A name that has been applied to magnesium alloy sheet clad with layers of a more anodic magnesium alloy.

**Magnesite:** A naturally occurring form of magnesium carbonate. ($MgCO_3$).

**Magnesium:** A silver-white metallic element, malleable, ductile and light (sp. gr., 1.74) Symbol—Mg. At. no. 12, At. wt. 24.32.

**Magnesium, Commercially Pure:** 99.80 pct magnesium. Total of all impurities 0.2 pct.

**Mill Products:** Wire, extrusions, sheets, plates, forgings. Any product in which a working of the metal has been involved.

**Plate:** Rolled magnesium 0.250 in. and over in thickness.

**Refine:** In magnesium melting practice, refining means the removal of magnesium oxide and other sus-


"I hear he's an expert from India who came over to study our machine tools."

*Turn Page*

## —Magnesium Terms—

pended matter by use of flux which wets the impurities and carries them to the bottom of the pot as sludge.

**Rod:** A round solid section that is 0.250 in. or more in diameter.

**Semi-closed Shape:** Any shape which approaches a hollow section, but does not have a fully enclosed void. (Note: Different manufacturers use different formulas for defining a semi-closed shape.)

**Serpentine:** A mineral ($_3MgO_2SiO_2$.-$2H_2O$) made up of magnesium and silicon oxides.

**Sheet:** Rolled magnesium through 0.249 in. in thickness.

**Solid Shape:** Any extruded shape other than a hollow or semi-closed extruded shape. Solid shapes may be divided into structural shapes and special shapes. Extruded structural shapes include angles, I-beams, tees, zees, and channels which conform closely to American Standard Sections. Special shapes include an extremely wide variety of extrusions which have been designed for specific purposes.

**Stress Corrosion Cracking:** Cracking due to the combined effects of stress and corrosion. Usually this type of failure occurs as a fine hairline crack which propagates across the section without any exterior sign of corrosion.

**Superheating:** A method of refining the grains of certain magnesium casting alloys. It consists of heating the metal several hundred degrees above the pouring temperature and then allowing the metal to cool slowly in the crucible until the pouring temperature is reached.

**Tolerance Limit:** (as applied to magnesium alloys). The specific critical amount of an impurity element which, if exceeded, results in a great increase in rate of corrosion in salt solutions.

**Tubing:** A hollow body whose wall is of uniform thickness, and whose cross section is round, square, rectangular, hexagonal, octagonal, or elliptical with sharp or rounded corners.

The Iron Age
FOUNDED 1855
Markets and Prices

# THE IRON AGE SUMMARY...

- **Ingot rate recoups part of holiday decline**
- **Steel industry set many new records in '53**
- **Labor will be an important market factor**

Steel producers in the U. S. have just rung down the curtain on their best year ever. But they cannot afford to rest on their many new records. Facing them is a more challenging year, when a buyers' market will test them sternly. As the new year begins, consumers show signs of increasing their orders, and bringing the steel market out of its year-end doldrums.

Here are some 1953 achievements which stand out on the steel industry scoreboard:

**Production of close to 112 million** net tons of raw steel in 1953 was an alltime record for the industry. This was a 20 pct gain over output the previous year. Higher capacity made achievement of this record a breeze; actually operations lagged during the latter half of the year, as production overtook demand.

**Steelmaking operations** during the year averaged 95.2 pct of rated capacity. High month for the year was March when the ingot rate averaged 101.8 pct of capacity. Low month was December, when slackening demand and holidays dragged the operating rate down to an average of 79.5 pct of capacity.

**Capacity rose to 124,330,410 net tons** per year at beginning of 1954, an increase of 6,782,940 tons or 5.8 pct over capacity of 117,547,470 tons at beginning of last year. The new capacity figure is, of course, the highest in history; the industry has established a new capacity record every year since 1948. Steel industry capacity has increased 32 million tons, or 35 pct in the 8 postwar years; since 1940 it has gained almost 43 million tons, or 52 pct.

**Steelmakers are counting on** renewed buying in the next several weeks to lift the market out of its year-end decline. It is expected that January business will be only slightly better than December. But steel people are hopeful that February and March will register gains. If this is to happen, order books should reflect it during the next few critical weeks.

Steelmaking operations this week are scheduled to advance for the second consecutive week, as the industry recoups from the Christmas low. The ingot rate is estimated at 83 pct of rated capacity, up 9.0 points from New Year's week and 18.0 points better than Christmas week.

**Labor will undoubtedly be** a factor in the steel market during the first half of the year. Contracts with most producers expire in their entirety June 30. In view of the union's avowed intention to exert strong pressure for sizable gains, there will likely be some second quarter ordering as a hedge against a possible strike.

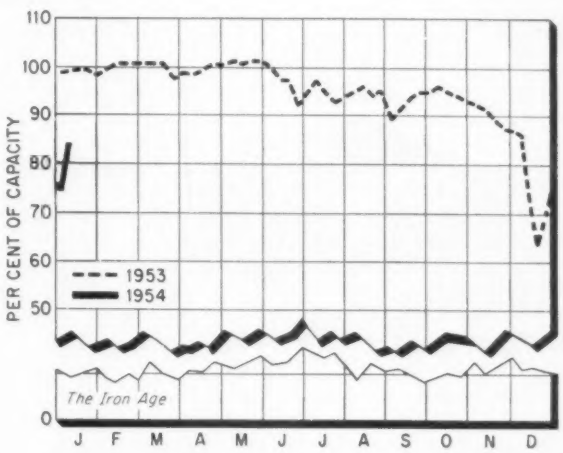
Union demands are expected to embrace higher pensions, more social insurance, higher wages, and guaranteed annual wage. Although emphasis this year will be on security, it is doubtful that any GAW concessions can be negotiated.

Other industries will be watching the steel industry as the pattern setter on wage agreements in 1954.

## Steel Operating Rates

| | Week of Jan. 3 | Week of Dec. 27 | | Week of Jan. 3 | Week of Dec. 27 |
|---|---|---|---|---|---|
| Pittsburgh | 90.0 | 75.0* | Detroit | 86.0 | 82.0 |
| Chicago | 80.0 | 87.0 | Birmingham | 95.0 | 80.5 |
| Philadelphia | 86.0 | 78.0* | Wheeling | 85.0 | 73.0* |
| Valley | 77.0 | 58.0 | S. Ohio River | 79.5 | 80.0 |
| West | 78.0 | 76.5* | St. Louis | 67.0 | 83.0 |
| Cleveland | 83.0 | 51.0 | East | 78.0 | 67.0 |
| Buffalo | 75.0 | 52.0 | **AGGREGATE** | **83.0** | **74.0** |

Beginning Jan. 1, 1954, operations are based on annual capacity of 117,547,470 net tons.
* Revised



*Brush six-channel magnetic oscillograph used to record output of an analog computer, which duplicates flight conditions for a jet plane. Photo courtesy Sperry Gyroscope Company.*

## MULTI-CHANNEL OSCILLOGRAPHS

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# Markets at a Glance

**Labor** . . . Responsibilities of labor in 1954 will be as great as management's. Some unions will abandon sparring tactics they've used in the past. But will they strike to support demands during a period of easing economy and increasing unemployment? Much depends on outcome of historically pattern-setting steel wage negotiations. Steelworkers have indicated they will try to win (1) higher pensions, (2) more social insurance, (3) higher wages, (4) guaranteed annual wage. They seem to have best chance on first two points, third is doubtful, fourth will be traded for other gains.

**Metal Consumption** . . . Bureau of Mines predicts 1954 U. S. metal consumption as follows (net tons): Refined copper, 1.35 million, off 150,000; lead, 1.15 million, off 70,000; zinc, exclusive of scrap, 937,000, off 163,000; aluminum, 1.75 million, up 15,000; primary nickel, 105,000, unchanged; tin, 85,000, off 2000; sponge titanium, 3500, up 1200; cobalt, 5400, unchanged; primary magnesium, 38,000, off 2000; molybdenum, 14,100, off 1700; chromite, 1.2 million, off 160,000; tungsten, 3700, off 100; and primary antimony, 12,000, off 1000.

**Machine Tools** . . . Shipments of machine tools during 1954 are expected to be around the $800 million mark compared with this year's $1.2 billion figure. Barring new hostilities, defense requirements will account for 10-12 pct of new orders.

**Aluminum Expansion** . . . Regardless of the outcome of the Alcoa-Alcan contract suit, the third round of aluminum expansion should be completed. That is the opinion of the Joint Committee on Defense Production. Reasoning is that current estimates of metal requirements are based on full production of all North American facilities—they don't take into account possible bombing or sabotage. Primary aluminum production last year is estimated at 1.25 million tons, a 33 pct increase over 1952.

**Cans** . . . Can production in 1953 is expected to top the 33.5 billion units turned out in 1952 and it is anticipated '54 output will be even greater, reports National Can Corp. Trend to watch is increased use of cans by the frozen food industry.

**Steel** . . . Due for a letdown from all-time record '53, steel industry will still probably have its third best year. It is expected consumers will call for production of about 100 million net tons of ingots. This would be a 10.6 pct decline from the 111.9 million tons poured in 1953. Spurred by spring buying, automotive production race, and possible strike-hedge buying, first half should be strong. If wage question is settled peacefully, there may be a slump during the hot months.

**Capital Goods** . . . Security Exchange Commission estimates outlay for new plant and equipment this year will be 1 pct below the 1953 level.

**Automotive** . . . Automakers turned out 6.165 million cars and 1.205 million trucks during 1953. Prospect for this year is that more than 5.543 million cars and 1.023 million trucks will come off assembly lines.

**Scrap** . . . Though the scrap industry is becalmed, a reasonably good shipping year in 1954 is looked for by many. Second quarter sales may reverse the current slump as steel production uncertainties clarify. Any substantial sales ahead may somewhat firm up prices but no resurgence is anticipated.

**Imports** . . . British economists are perturbed by predictions that there will be a 5 pct decline in the U. S. boom this year. They believe each 1 pct drop in U. S. economic activity will be reflected in a 5 pct decline in U. K. exports to America.

## Prices At A Glance

*(cents per lb unless otherwise noted)*

| Composite Prices | This Week | Last Week | Last Month | Last Year |
|---|---|---|---|---|
| Finished Steel, base | 4.634 | 4.634 | 4.634 | 4.376 |
| Pig Iron (gross ton) | $56.59 | $56.59 | $56.59 | $55.26 |
| Scrap, No. 1 hvy. (Gross ton) | $29.67 | $30.17 | $32.00 | $42.00 |
| **Nonferrous Metals** | | | | |
| Aluminum, ingot | 21.50 | 21.50 | 21.50 | 20.00 |
| Copper, electrolytic | 29.75 | 29.75 | 29.75 | 24.50 |
| Lead, St. Louis | 13.30 | 13.30 | 13.30 | 14.55 |
| Magnesium, ingot | 27.00 | 27.00 | 27.00 | 24.50 |
| Nickel, electrolytic | 63.08 | 63.08 | 63.08 | 59.58 |
| Tin, Straits, N. Y. | 84.50 | 84.50 | 85.75 | $1.21½ |
| Zinc, E. St. Louis | 10.00 | 10.00 | 10.00 | 13.00 |

# Easing Effects Will Vary In Metals

**Ample supplies, softer markets will prevail with some exceptions . . . Aluminum output may top 1.4 million tons . . . Copper price seen dipping to 25¢—By R. L. Hatschek.**

Ample supplies and easing prices will generally prevail in the metal markets during the New Year. But there will be a few exceptions. Overall level of metal demand will decline with slipping industrial activity and cutbacks in military production. Metal by metal, here's the picture:

**Aluminum** . . . Record production of 1.25 million tons in 1953 will be surpassed and a new peak of 1.4 million or more tons of primary metal will be produced. Selling will be more and more competitive and added emphasis will be placed on market development.

Look for many new applications of the metal as well as new or modified mill products by the producers in their efforts to win markets from older established metals.

Barring labor trouble, prices will remain steady at present levels. If the union wins healthy concessions in the steel industry, aluminum will follow and base prices will get a slight upward revision.

**Copper** . . . Demand will be off, supplies will continue fairly high, Chilean metal will come more strongly into the picture. Result of these combined forces will be a weakening price structure. In most quarters it's expected that copper will be available at 25¢ per lb by the middle of the year.

Accelerated stockpiling in the U. S. could delay this. It depends on just how heavily Uncle Sam comes into the market—something that security prevents revealing.

**Lead, Zinc** . . . These two will also suffer from dipping demand, resulting largely from lower production rates in the automotive industry. Zinc, already in poorer shape than lead, will be hit harder. Prices for both could come down fractionally but probably not until late spring or early summer.

Declining mine and smelter production of zinc will help even out supply and demand.

You can expect to hear more arguments for increased tariff protection—either a higher fixed rate or a variable duty—to help the ailing miners. The forthcoming Randall Commission report may kill these hopes. If so, the proponents of government subsidy assistance will probably add numbers to their ranks.

**Nickel** . . . Of all the major metals and alloying agents, nickel stands out by remaining extremely tight. Free World production during the year is predicted at 192,500 tons as compared to 170,000 tons in 1953. Demand is extremely strong since the freeing of nickel for civilian use.

Most of the 1954 production is under contract to the U. S. government for stockpiling and military purposes. Cutbacks in military production and easing in the general industrial scene will loosen nickel supplies somewhat—but it will still be in the tight class.

**Magnesium** . . . Still a relatively "new" metal industrially, magnesium availability is far ahead of civilian demand. Military use is declining and stockpiling is over. But watch for new applications—including military—to soften the impact of lower industrial production.

The magnesium industry is aggressively seeking new fields for conquest and reduced prices for mill products are a strong possibility in the efforts to make magnesium more attractive to users of other metals.

**Titanium** . . . Like other new metals, titanium is still hampered by excessive prices and technological difficulties. Yet the properties displayed by titanium make it well worth the price in many uses.

The dilemma: Should the U. S. base a huge titanium expansion on the present process or should it hope for early development of a new one. A team of scientists is studying the problem.

### MONTHLY AVERAGE PRICES

The average prices of the major nonferrous metals in December, based on quotations appearing in THE IRON AGE were as follows:

| | Cents Per Pound |
|---|---|
| Electrolytic copper, Conn. Valley | 29.750 |
| Lake Copper, delivered | 30.063 |
| Straits tin, New York | 84.614 |
| Zinc, East St. Louis | 10.00 |
| Zinc, New York | 10.50 |
| Lead, St. Louis | 13.30 |
| Lead, New York | 13.50 |

### NONFERROUS METAL PRICES

*(Cents per lb except as noted)*

| | Dec. 30 | Dec. 31 | Jan. 1 | Jan. 2 | Jan. 4 | Jan. 5 |
|---|---|---|---|---|---|---|
| Copper, electro, Conn. | 29.50–30.00 | 29.50–30.00 | .... | 29.50–30.00 | 29.50–30.00 | 29.50–30.00 |
| Copper, Lake delivered | 30.00 | 30.00 | .... | 30.00 | 30.00 | 30.00 |
| Tin, Straits, New York | 84.50 | 84.50 | .... | .... | 84.50 | 84.50* |
| Zinc, East St. Louis | 10.00 | 10.00 | .... | 10.00 | 10.00 | 10.00 |
| Lead, St. Louis | 13.30 | 13.30 | .... | 13.30 | 13.30 | 13.30 |

Note: Quotations are going prices
*Tentative

# Nonferrous Prices

*(Effective Jan. 5, 1954)*

## MILL PRODUCTS

*(Cents per lb, unless otherwise noted)*

### Aluminum

*(Base 30,000 lb, f.o.b. ship. pt. frt. allowed)*

**Flat Sheet:** 0.136 in. and thicker, 2S, 3S, 33.9¢; 4S, 36.0¢; 52S, 38.2¢; 24S-O, 24S-OAL, 37.0¢; 75S-O, 75S-OAL, 44.7¢; 0.081-in., 2S, 3S, 35.1¢; 4S, 37.7¢; 52S, 39.9¢; 24S-O, 24S-OAL, 38.4¢; 75S-O, 75S-OAL, 46.9¢. 0.032-in., 2S, 3S, 37.0¢; 4S, 41.8¢; 24S-O, 24S-OAL, 46.9¢; 75S-O, 75S-OAL, 58.4¢.

**Plate, ¼-in. and Heavier:** 2S-F, 3S-F, 32.4¢; 4S-F, 34.5¢; 52S-F, 36.2¢; 61S-O, 35.6¢; 24S-O, 24S-OAL, 36.9¢; 75S-O, 75S-OAL, 44.3¢.

**Extruded Solid Shapes:** Shape factors 1 to 5, 37.4¢ to 82.8¢; 12 to 14, 38.2¢ to 99.0¢; 24 to 26, 40.9¢ to $1.29; 36 to 38, 48.4¢ to $1.89.

**Rod, Rolled:** 1.064 to 4.5-in., 2S-F, 3S-F, 43.8¢ to 37.2¢; cold-finished, 0.375 to 3.499-in., 2S-F, 3S-F, 47.6¢ to 39.3¢.

**Screw Machine Stock:** Rounds, 11S-T3, ½ to 11/32-in., 59.6¢ to 47.0¢; ⅝ to 1½-in., 46.6¢ to 43.8¢; 1 9/16 to 3-in., 42.7¢ to 39.9¢. Base 5000 lb.

**Drawn Wire:** Coiled 0.051 to 0.374-in., 2S, 44.1¢ to 32.4¢; 52S, 53.4¢ to 39.1¢; 17S-T4, 60.1¢ to 41.8¢; 61S-T4, 53.9¢ to 41.3¢.

**Extruded Tubing:** Rounds, 63S-T5, OD 1¼ to 2-in., 31.6¢ to 60.7¢; 2 to 4 in., 37.7¢ to 51.1¢; 4 to 6 in., 38.2¢ to 46.6¢; 6 to 9 in., 38.7¢ to 48.8¢.

**Roofing Sheet:** Flat, per sheet, 0.032-in., 42¾ x 60 in., $2.838; x 96 in., $4.543; x 120 in., $5.680; x 144 in., $6.816. Coiled sheet, per lb, 0.019 in. x 28 in.

### Magnesium

*(F.o.b. mill, freight allowed)*

**Sheet and plate:** FS1-O¼ in., 66¢; 3/16 in., 68¢; ½ in., 70¢; B & S Gage 10, 71¢; 12, 75¢. Specifications grade higher. Base: 30,000 lb.

**Extruded Round Rod:** M, diam ¼ to 0.311 in., 77¢; ½ to ¾ in., 60.5¢; 1¼ to 1.749 in., 56¢; 2½ to 5 in., 51.5¢. Other alloys higher. Base up to ¾ in. diam, 10,000 lb; ¾ to 2 in., 20,000 lb; 2 in. and larger, 30,000 lb.

**Extruded Solid Shapes: Rectangles:** M. In weight per ft, for perimeters less than size indicated: 0.10 to 0.11 lb, 3.5 in., 65.3¢; 0.22 to 0.25 lb, 5.9 in., 62.3¢; 0.50 to 0.59 lb, 8.6 in., 59.7¢; 1.8 to 2.59 lb, 19.5 in., 56.8¢; 4 to 6 lb, 28 in., 52¢. Other alloys higher. Base, in weight per ft of shape: Up to ½ lb, 10,000 lb; ½ to 1.80 lb, 20,000 lb; 1.80 lb and heavier, 30,000 lb.

**Extruded Round Tubing:** M, 0.049 to 0.057 in. wall thickness: OD, ¼ to 5/16 in., $1.43; 5/16 to ⅜ in., $1.29; ½ to ⅝ in., 96¢; 1 to 2 in., 79¢; 0.165 to 0.219 in. wall; OD, ⅝ to ¾ in., 64¢; 1 to 2 in., 60¢; 3 to 4 in., 59¢. Other alloys higher. Base, OD: Up to 1½ in., 10,000 lb; 1½ to 3 in., 20,000 lb; over 3 in., 30,000 lb.

### Titanium

*(100,000 lb base, f.o.b. mill)*

Commercially pure and alloy grades; Sheets and strip, HR or CR, $15; Plate, HR, $12; Wire, rolled and/or drawn, $10; Bar, HR or forged, $6; Forgings, $6.

### Nickel, Monel, Inconel

*(Base prices, f.o.b. mill)*

| | "A" Nickel | Monel | Inconel |
|---|---|---|---|
| Sheet, CR | 86½ | 67½ | 92½ |
| Strip, CR | 92½ | 70½ | 98½ |
| Rod, bar | 82½ | 65½ | 88½ |
| Angles, HR | 82½ | 65½ | 88½ |
| Plate, HR | 84½ | 66½ | 90½ |
| Seamless Tube | 115½ | 100½ | 137½ |
| Shot, blocks | .... | 60 | .... |

### Copper, Brass, Bronze

*(Freight included on 500 lb)*

| | Sheet | Rods | Extruded Shapes |
|---|---|---|---|
| Copper | 46.41 | .... | 48.48 |
| Copper, h-r | 48.38 | 44.73 | .... |
| Copper, drawn | .... | 45.98 | .... |
| Low brass | 44.47 | 44.41 | .... |
| Yellow brass | 41.72 | 41.66 | .... |
| Red brass | 45.44 | 45.38 | .... |
| Naval brass | 45.76 | 40.07 | 41.33 |
| Leaded brass | .... | .... | 39.11 |
| Com. bronze | 46.95 | 46.89 | .... |
| Mang. bronze | 49.48 | 43.62 | 45.18 |
| Phos. bronze | 66.58 | 67.08 | .... |
| Muntz metal | 43.96 | 39.77 | 41.02 |
| Ni silver, 10 pct | 55.36 | .... | 62.63 |

## PRIMARY METALS

*(Cents per lb, unless otherwise noted)*

| | |
|---|---|
| Aluminum ingot, 99+%, 10,000 lb, freight allowed | 21.50 |
| Aluminum pig | 20.00 |
| Antimony, American, Laredo, Tex. | 28.50 |
| Beryllium copper, per lb conta'd Be. | $40.00 |
| Beryllium aluminum 5% Be, Dollars per lb contained Be | $72.75 |
| Bismuth, ton lots | $2.25 |
| Cadmium, del'd | $2.00 |
| Cobalt, 97-99% (per lb) | $2.60 to $2.67 |
| Copper, electro, Conn. Valley | 29.50 to 30.00 |
| Copper, Lake, delivered | 30.00 |
| Gold, U. S. Treas., dollars per oz. | $35.00 |
| Indium, 99.8%, dollars per troy oz. | $2.25 |
| Iridium, dollars per troy oz. | $165 to $175 |
| Lead, St. Louis | 13.30 |
| Lead, New York | 13.50 |
| Magnesium, 99.8+%, f.o.b. Freeport, Tex., 10,000 lb. | 27.00 |
| Magnesium, sticks, 100 to 500 lb. | 45.00 to 47.00 |
| Mercury, dollars per 76-lb flask, f.o.b. New York | $186 to $189 |
| Nickel electro, f.o.b. N. Y. warehouse | 63.08 |
| Nickel oxide sinter, at Copper Creek, Ont., contained nickel | 56.25 |
| Palladium, dollars per troy oz. | $22 to $24 |
| Platinum, dollars per troy oz. | $91 to $93 |
| Silver, New York, cents per oz. | 85.25 |
| Tin, New York | 84.50 |
| Titanium, sponge | $5.00 |
| Zinc, East St. Louis | 10.00 |
| Zinc, New York | 10.50 |
| Zirconium copper, 50 pct | $6.20 |

## REMELTED METALS

### Brass Ingot

*(Cents per lb delivered carloads)*

| | |
|---|---|
| 85-5-5-5 ingot | |
| No. 115 | 24.50 |
| No. 120 | 23.75 |
| No. 123 | 23.25 |
| 80-10-10 ingot | |
| No. 305 | 28.75 |
| No. 315 | 26.50 |
| 88-10-2 ingot | |
| No. 210 | 37.50 |
| No. 215 | 34.00 |
| No. 245 | 29.50 |
| Yellow ingot | |
| No. 405 | 20.75 |
| Manganese bronze | |
| No. 421 | 25.25 |

### Aluminum Ingot

*(Cents per lb del'd 30,000 lb and over)*

| | |
|---|---|
| 95-5 aluminum-silicon alloys | |
| 0.30 copper, max. | 22.75-23.75 |
| 0.60 copper, max. | 22.50-23.25 |
| Piston alloys (No. 122 type) | 20.50-21.50 |
| No. 12 alum. (No. 2 grade) | 19.50-20.25 |
| 108 alloy | 20.50-21.25 |
| 195 alloy | 21.50-22.25 |
| 13 alloy (0.60 copper max.) | 22.50-23.25 |
| ASX-679 | 20.50-21.25 |

### Steel deoxidizing aluminum, notch-bar granulated or shot

| | |
|---|---|
| Grade 1—96-97½% | 20.75-21.50 |
| Grade 2—92-95% | 19.75-20.50 |
| Grade 3—90-92% | 18.50-19.50 |
| Grade 4—85-90% | 17.00-18.00 |

## ELECTROPLATING SUPPLIES

### Anodes

*(Cents per lb, freight allowed, 5000 lb lots)*

| | |
|---|---|
| Copper | |
| Cast, oval, 15 in. or longer | 44.54 |
| Electrodeposited | 38.38 |
| Flat rolled | 47.14 |
| Brass, 80-20 | |
| Cast, oval, 15 in. or longer | 43.515 |
| Zinc, flat cast | 20.25 |
| Ball, anodes | 18.50 |
| Nickel, 99 pct plus | |
| Cast | 84.00 |
| Cadmium | $2.15 |
| Silver 999 fine, rolled, 100 oz. lots, per troy oz, f.o.b. Bridgeport, Conn. | 94⅛ |

### Chemicals

*(Cents per lb, f.o.b. shipping points)*

| | |
|---|---|
| Copper cyanide, 100 lb drum | 63.90 |
| Copper sulfate, 99.5 crystals, bbl. | 12.85 |
| Nickel salts, single or double, 4-100 lb bags, frt. allowed | 30.00 |
| Nickel chloride, 375 lb drum | 38.00 |
| Silver cyanide, 100 oz. lots, per oz. | 75½ |
| Sodium cyanide, 96 pct domestic 200 lb drums | 19.25 |
| Zinc cyanide, 100 lb drum | 54.30 |

## SCRAP METALS

### Brass Mill Scrap

*(Cents per pound, add 1¢ per lb for shipments of 20,000 lb and over)*

| | Heavy | Turnings |
|---|---|---|
| Copper | 26 | 25¼ |
| Yellow brass | 19¾ | 18 |
| Red brass | 23 | 22¼ |
| Comm. bronze | 23⅞ | 23⅛ |
| Mang. bronze | 18¼ | 17¼ |
| Yellow brass rod ends | 19½ | .... |

### Custom Smelters' Scrap

*(Cents per pound carload lots, delivered to refinery)*

| | | |
|---|---|---|
| No. 1 copper wire | 24 | —24½ |
| No. 2 copper wire | | 22½ |
| Light copper | | 21 |
| *Refinery brass | 19½ | —20 |

*Dry copper content.

### Ingot Makers' Scrap

*(Cents per pound carload lots, delivered to refinery)*

| | | |
|---|---|---|
| No. 1 copper wire | 24 | —24½ |
| No. 2 copper wire | 22½ | —23 |
| Light copper | 21 | —21½ |
| No. 1 composition | 17½ | —18½ |
| No. 1 comp. turnings | 17 | —18 |
| Rolled brass | 14½ | —15½ |
| Brass pipe | 15 | —16 |
| Radiators | 13½ | —14 |
| *Aluminum* | | |
| Mixed old cast | 11 | —11½ |
| Mixed new clips | 12¾ | —13½ |
| Mixed turnings, dry | 11¼ | —12 |
| Pots and pans | 11 | —11½ |

### Dealers' Scrap

*(Dealers' buying price, f.o.b. New York in cents per pound)*

#### Copper and Brass

| | | |
|---|---|---|
| No. 1 heavy copper and wire | 23 | —23½ |
| No. 2 heavy copper and wire | 21 | —21½ |
| Light copper | 19 | —19½ |
| New type shell cuttings | 19 | —19½ |
| Auto radiators (unsweated) | 12½ | —13 |
| No. 1 composition | 17 | —17½ |
| No. 1 composition turnings | 16 | —17 |
| Unlined red car boxes | 14½ | —15 |
| Cocks and faucets | 14½ | —15 |
| Mixed heavy yellow brass | 11 | —11½ |
| Old rolled brass | 14 | —14½ |
| Brass pipe | 16 | —16½ |
| New soft brass clippings | 17 | —17½ |
| Brass rod ends | 14 | —15 |
| No. 1 brass rod turnings | 12 | —12½ |

#### Aluminum

| | | |
|---|---|---|
| Alum. pistons and struts | 6 | — 6½ |
| Aluminum crankcase | 9 | — 9½ |
| 2S aluminum clippings | 12 | —12½ |
| Old sheet and utensils | 9 | — 9½ |
| Borings and turnings | | 6 |
| Misc. cast aluminum | 9 | — 9½ |
| Dural clips (24S) | 10 | —10½ |

#### Zinc

| | | |
|---|---|---|
| New zinc clippings | 5 | — 5½ |
| Old zinc | 3½ | — 4 |
| Zinc routings | 2 | — 2½ |
| Old die cast scrap | 2½ | — 3¼ |

#### Nickel and Monel

| | | |
|---|---|---|
| Pure nickel clippings | 60 | —65 |
| Clean nickel turnings | | 40 |
| Nickel anodes | 60 | —65 |
| Nickel rod ends | 60 | —65 |
| New Monel clippings | 22 | —24 |
| Clean Monel turnings | 14 | —15 |
| Old sheet Monel | 20 | —22 |
| Nickel silver clippings, mixed | | 14 |
| Nickel silver turnings, mixed | | 12 |

#### Lead

| | | |
|---|---|---|
| Soft, scrap, lead | | 10½ |
| Battery plates (dry) | 5½ | — 5⅝ |
| Batteries, acid free | | 3½ |

#### Magnesium

| | | |
|---|---|---|
| Segregated solids | 20 | —21 |
| Castings | 19 | —20 |

#### Miscellaneous

| | | |
|---|---|---|
| Block tin | 65 | —67 |
| No. 1 pewter | 40 | —45 |
| No. 1 auto babbitt | 37 | —38 |
| Mixed common babbitt | 11 | —12 |
| Solder joints | 14 | —14½ |
| Siphon tops | | 35 |
| Small foundry type | | 15 |
| Monotype | | 13¼ |
| Lino. and stereotype | | 12½ |
| Electrotype | | 11 |
| Hand picked type shells | 7 | — 8 |
| Lino. and stereo. dross | 4¾ | — 5¼ |
| Electro dross | 3¼ | — 3½ |

# New Year Should Improve Dull Market

**Scrap activity should reflect generally good business outlook for first half at least . . . See good mill orders . . . But high ore stockpiles will act as curb on price increases.**

Predictions are always dangerous, and doubly so in as volatile an industry as scrap. But with 1954 just born, there are a few indicators that are worth watching—they may grow up into full size trends over the next few months.

Mills, faced with production uncertainties plus heavy raw materials inventories, have been reluctant to place scrap orders. But indications are that business will stay high for first half at least, and probably thereafter. It seems safe to bet that scrap prices will strengthen during the winter. The trade claims they can't go much lower. But record iron ore stockpiles at mills mean the threat of more hot metal use could act as a ceiling on scrap price activity.

Cast movement should be fairly good in the first half, although the customary vacation slump in foundry business will be felt next summer. Despite a slow and painful start into 1954, the scrap industry can reasonably look forward to a relatively good year, although admittedly under 1953's palmiest days.

**Pittsburgh** — Prices moved downward again this week on basis of offers to sell and continued weakness in adjoining markets. No. 1 heavy melting is off $1 per ton to a top of $31. Demand is virtually non-existent as consumers postponed new purchases into the new year. Combination of high inventories and lower ingot rates makes some consumers reluctant even to take in customer scrap. Blast furnace grades developed further weakness, declining $1 per ton.

**Chicago**—Scrap activity here was slow, and buying by area mills was directed strongly toward industrial material with rigid inspection the rule. What buying there was came in small lots. The railroad picture wasn't clear pending some activity expected for early next week. First guessers figure a probable drop, already presaged by a continuing of the reroller rail and axle slide that began last week. Cast, though volume was slow, continued to hold its present levels. After talking about "ending the slide" and a "firming of prices at present levels" for some time, it appears that scrap men are beginning to take action based on a stronger market in early January. A little scrap is being laid away for what might be a brighter New Year.

**Philadelphia**—The year turned with a gloomy outlook in the scrap trade. In general, the picture was unchanged from the previous week and scrap men were hoping that mill buyers would revalue their positions this month and come into the market more heavily. In some quarters this was doubted and it was felt that January wouldn't be much better than December. Some predicted there wouldn't be any major upturn until March.

**New York**—Reports that a major East Coast consumer would place no January scrap orders further depressed already low steelmaking grade scrap prices $2 all along the line. Movement is virtually non-existent. Trade sources feel that turnings have about reached bottom, while cast, aside from the holiday lull, stays fairly good.

**Detroit**—Purchasers of steelmaking grades and turnings for local consumption appeared to have stabilized the market here for the moment. Translated into dollars, turnings picked up about $1, while steelmaking grades gained or held firm. Industrial lists also showed more strength than generally predicted, with No. 1 automotive bundles bringing between $25.60 and $25.75 on track and some outstate top quality bundles $26.7[illegible] delivered to the dock in Detroit.

**Cleveland**—Sale of No. 1 heavy melting to a Valley consumer at $3[illegible] has sent all openhearth grades Youngstown and Cleveland down $ Blast furnace grades in both area were also off $1. With nothing bu distress scrap moving outlook fo January is not good. At least tw consumers in the area say they won' release orders even after the first o the year.

**Birmingham**—Two steel mills came back into the market on the last day of the year, purchasing quantities o No. 2 heavy melting at prices $1 be low those previously paid. Othe grades were not wanted. The cast iron market is growing weaker but prices are unchanged, although some brokers predict a drop early in the year.

**St. Louis**—Because of the Christmas holidays there was virtually no activity in the scrap market last week. Brokers are hopeful that mills will come into the market soon but are not expecting any heavy commitments. Prices are unchanged.

**Cincinnati** — Openhearth grades dropped $2 in Cincinnati this week on appraisal of a very weak market. Some sources feel that a brokers' buying price of $27 for No. 1 heavy melting may sink lower if local consumption doesn't materialize. Low phos and random length rails also eased off in the dull year-end market.

**Boston**—Complete lack of activity characterized the New England market as 1954 was born. No. 1 steel and No. 1 bundles dipped $2 to $20 per ton. This is the level brokers figure they'd better not exceed if they want to stay out of the red column on business they may get from eastern Pennsylvania mills. No. 2 steelmaking grades are priced on possibilities from Pittsburgh.

**West Coast**—Scrap inventories remain high at all steel plants and at least one will drop out of market entirely in January. Market is so inactive that present prices will probably remain steady throughout January with little prospect of upward changes. Cast grades holding firm.